Stat6021_Project2

Group 5

11/12/2019

Adult is the data set from 1994 Census database was offered by Barry Becker. (https://archive.ics.uci.edu/ml/datasets/adult). The Prediction task is to determine whether a person makes over $50K a year. Based on economic inflation (http://www.in2013dollars.com/us/inflation/1994?amount=50000), **$50K in 1994 is today (2019) worth $86K.** The reader can keep this in mind if the society structure is not changed. This work aims to predict whether or not an individual can earn $86K.

We start by data cleaning and mutating the data, since a number of the categorical variables have many classes. We broaden these classes and redefine new ones. In order to obtain the whole picture of this dataset, we make box plots grouped by income (>$50K, <$50K) first. The understanding the statistically significant predictors is important before we proceed machine learning.

```
## store data file with the variable name data
## data cleaning
## import library
library(stringr)
library(ggplot2)
library(dplyr)

##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union

library(ROCR)

## Loading required package: gplots

##
## Attaching package: 'gplots'

## The following object is masked from 'package:stats':
##
##     lowess

library(boot)
library(extrafont)
```

```
## Registering fonts with R
```

```r
library(ggthemes)
data<-read.csv("adult.csv", header=FALSE ,sep=",", na.string = "?")
#str_replace(data, "-", ".")
nr<-nrow(data)
df<-data.frame(data)
df = df[-1,] # row 1, sex has unwanted lable
df[1, 1] <-39
df<- na.omit(df)
row.names(df) <- 1:nrow(df)
data<-df

colnames(data)<-c("age","workclass", "fnlwgt", "education", "education_num",
"marital_status", "occupation", "relationship", "race", "sex",
"capital_gain", "capital_loss", "hours_per_week", "native_country", "income")
attach(data)
#data

#remoce missing data
data <- na.omit(data)

is.numeric(age)
```

```
## [1] FALSE
```

```r
age <-as.numeric(age)
is.numeric(age)
```

```
## [1] TRUE
```

```r
is.numeric(fnlwgt)
```

```
## [1] TRUE
```

```r
is.numeric(education_num)
```

```
## [1] TRUE
```

```r
is.numeric(capital_gain)
```

```
## [1] TRUE
```

```r
is.numeric(capital_loss)
```

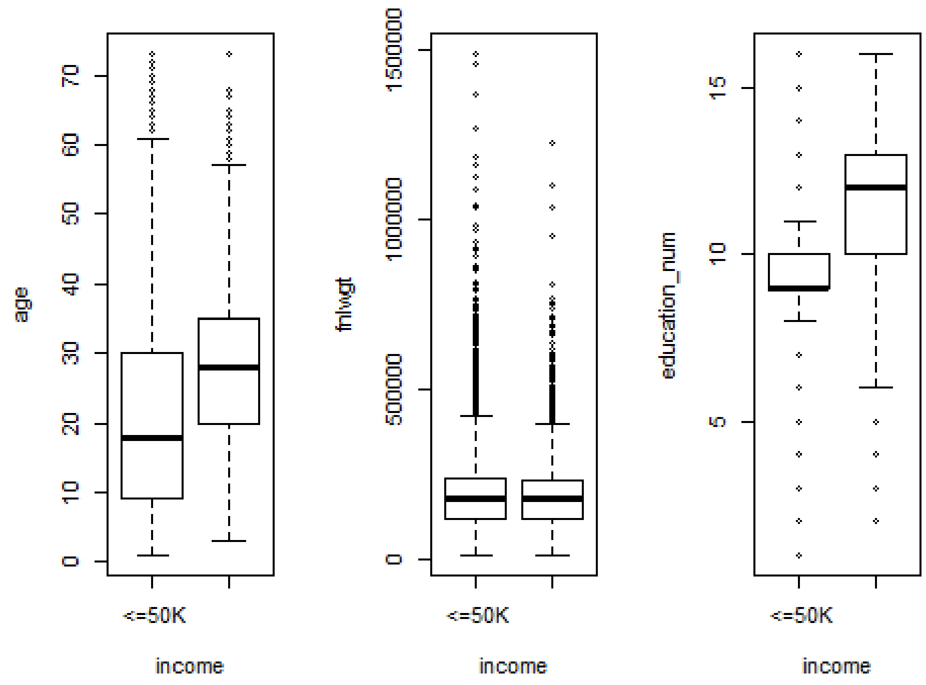
```
## [1] TRUE
```

```r
is.numeric(hours_per_week)
```

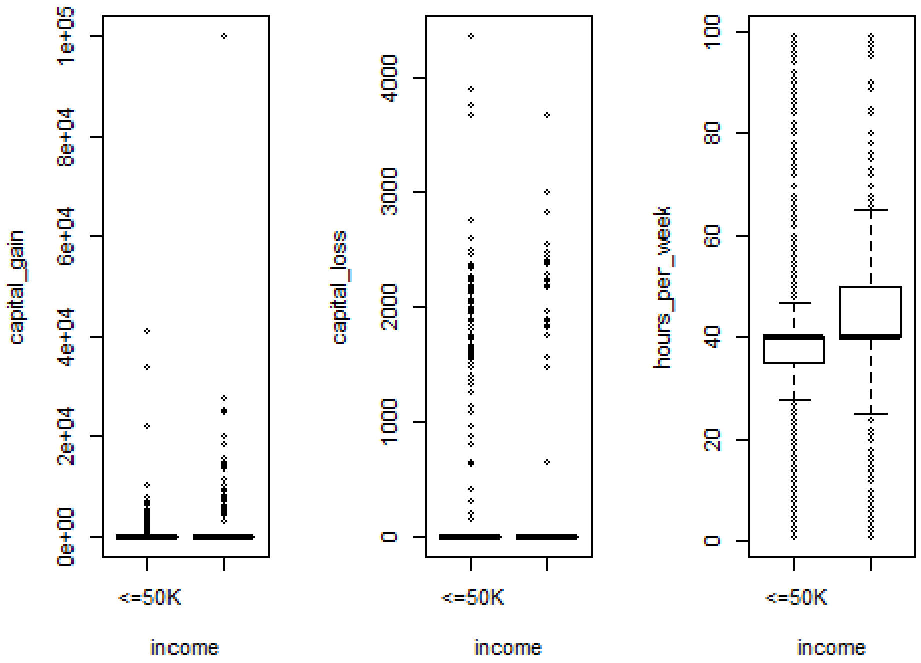
```
## [1] TRUE
```

```r
#Use box plot to see each predictor vs. income
##############
par(mfrow=c(1,3))
```

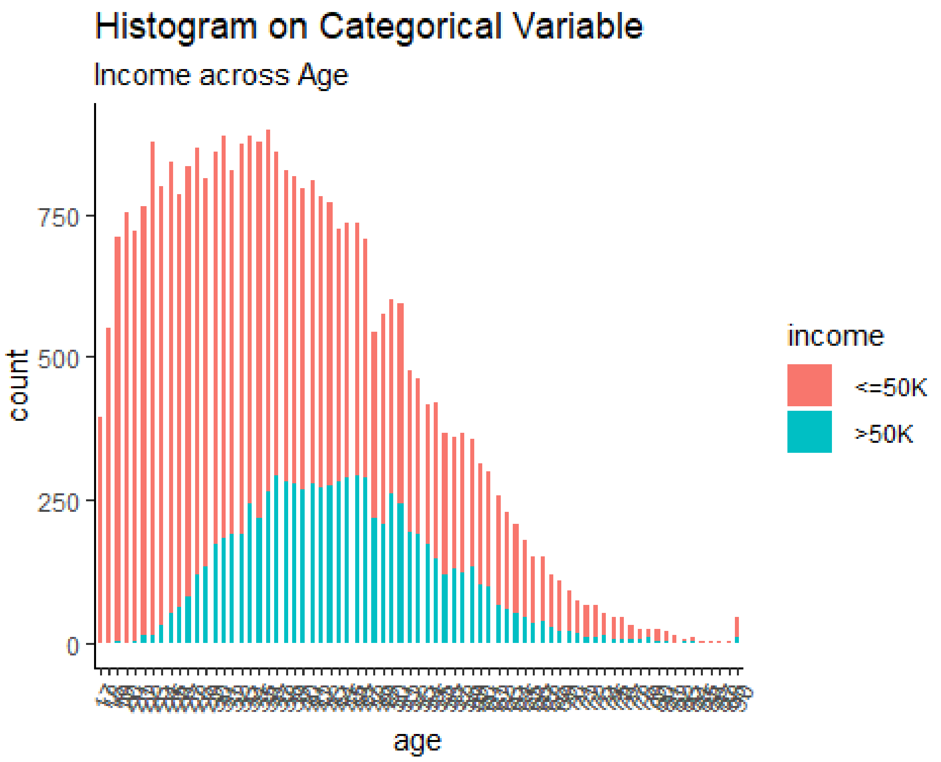
```r
boxplot(age~income)
boxplot(fnlwgt~income)

###############
boxplot(education_num~income)
```



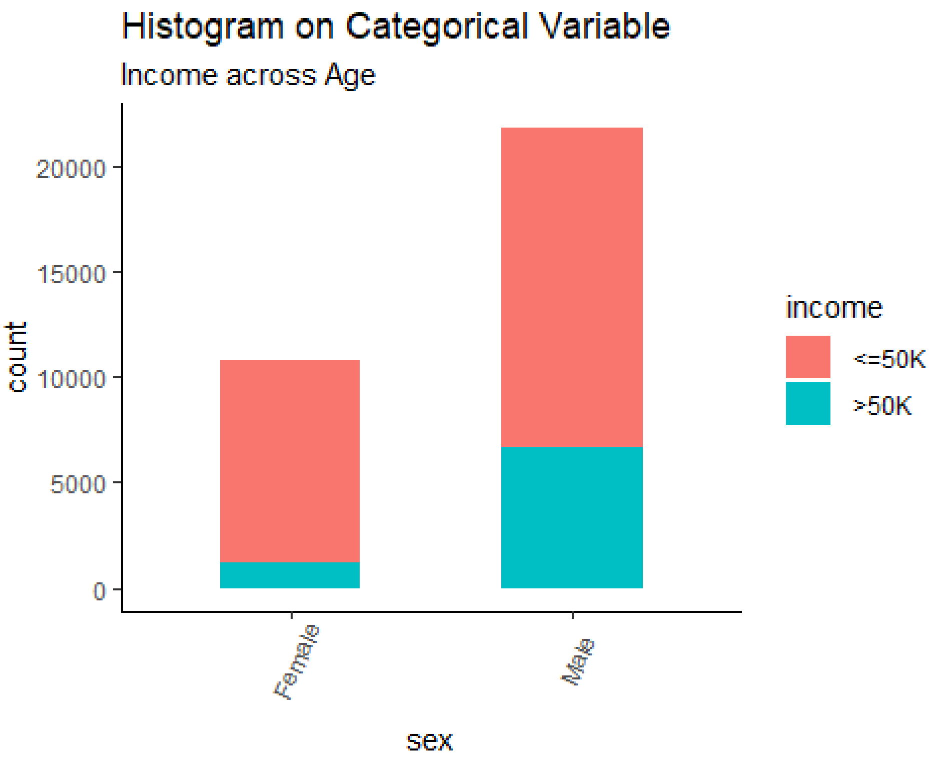
```r
###############

boxplot(capital_gain~income)
boxplot(capital_loss~income)
###############
boxplot(hours_per_week~income)
```



```
###############

theme_set(theme_classic())

# Histogram on a Categorical variable
g <- ggplot(data, aes(age))
g + geom_bar(aes(fill=income), width = 0.5) +
  theme(axis.text.x = element_text(angle=65, vjust=0.6)) +
  labs(title="Histogram on Categorical Variable",
       subtitle="Income across Age")
```

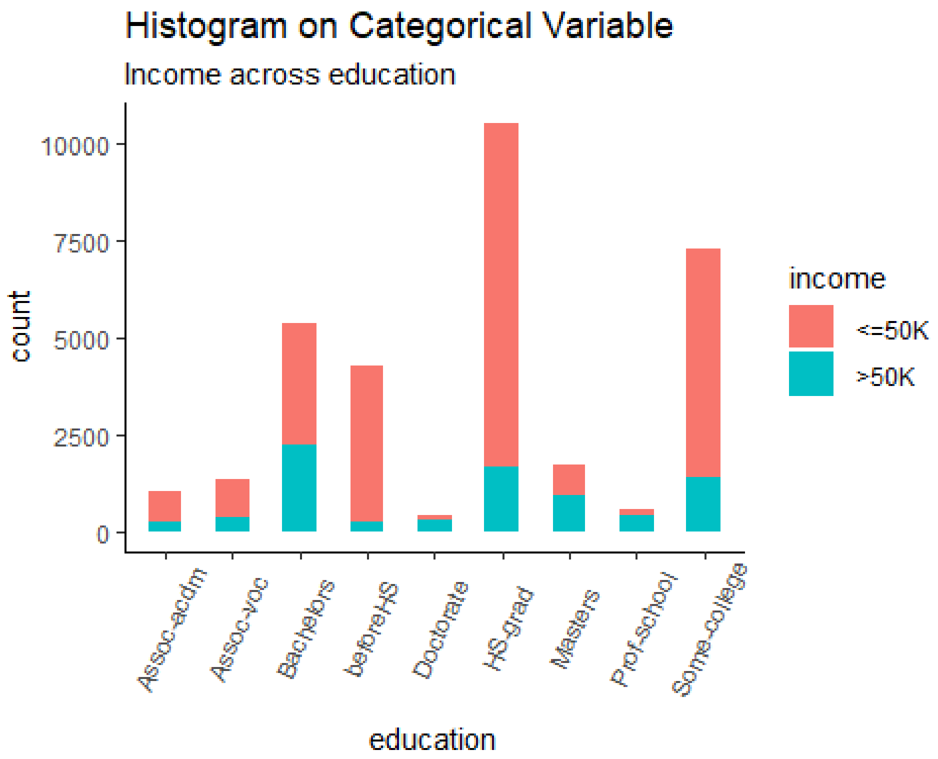


```
theme_set(theme_classic())

# Histogram on a Categorical variable
g <- ggplot(data, aes(sex))
g + geom_bar(aes(fill=income), width = 0.5) +
  theme(axis.text.x = element_text(angle=65, vjust=0.6)) +
  labs(title="Histogram on Categorical Variable",
       subtitle="Income across Age")
```



```
data$education <- trimws(data$education)

summary(data$education)

##    Length     Class      Mode
##     32560 character character

###combine high school below or 12th together
data$education <-gsub('^12th', 'beforeHS', data$education)
data$education <-gsub('^10th', 'beforeHS', data$education)
data$education <-gsub('^11th', 'beforeHS', data$education)
data$education <-gsub('^1st-4th', 'beforeHS', data$education)
data$education <-gsub('^5th-6th', 'beforeHS', data$education)
data$education <-gsub('^7th-8th', 'beforeHS', data$education)
data$education <-gsub('^9th', 'beforeHS', data$education)
data$education <-gsub('^Preschool', 'beforeHS', data$education)
data$education<-as.factor(data$education)

summary(data$education)

##   Assoc-acdm    Assoc-voc    Bachelors     beforeHS    Doctorate
##         1067         1382         5354         4253          413
##      HS-grad      Masters  Prof-school Some-college
##        10501         1723          576         7291

theme_set(theme_classic())

# Histogram on a Categorical variable
```

```r
g <- ggplot(data, aes(education))
g + geom_bar(aes(fill=income), width = 0.5) +
  theme(axis.text.x = element_text(angle=65, vjust=0.6)) +
  labs(title="Histogram on Categorical Variable",
       subtitle="Income across education")
```



```r
summary(data$workclass)
```

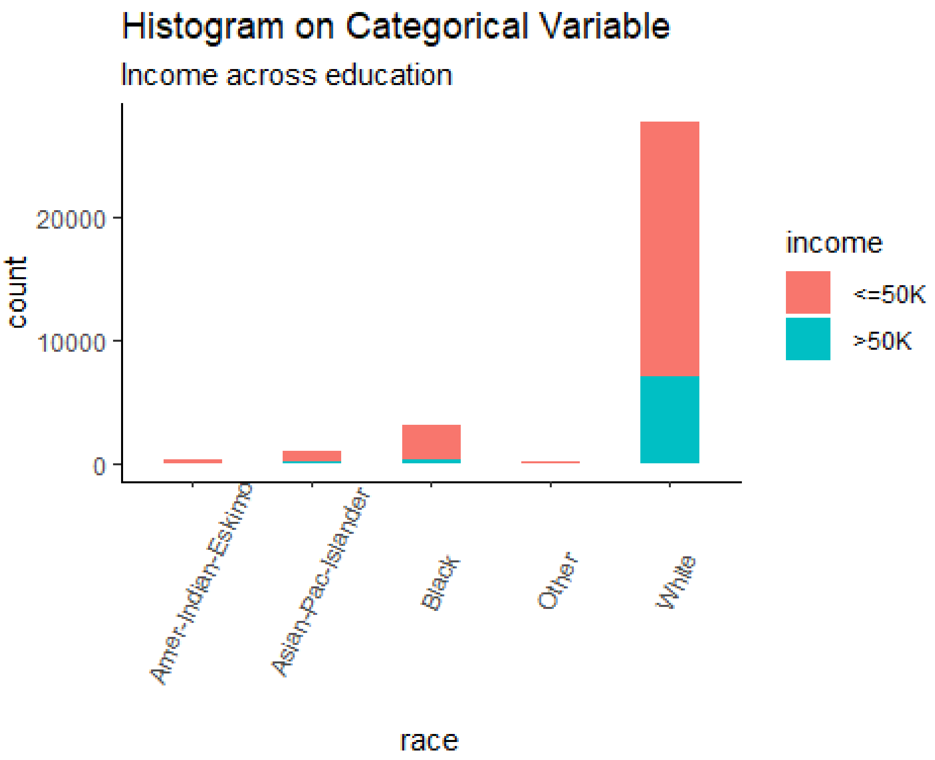
```
##                ?      Federal-gov        Local-gov     Never-worked 
##             1836              960             2093                7 
##          Private     Self-emp-inc Self-emp-not-inc        State-gov 
##            22696             1116             2541             1297 
##      Without-pay 
##               14
```

```r
data$workclass <- trimws(data$workclass)
```

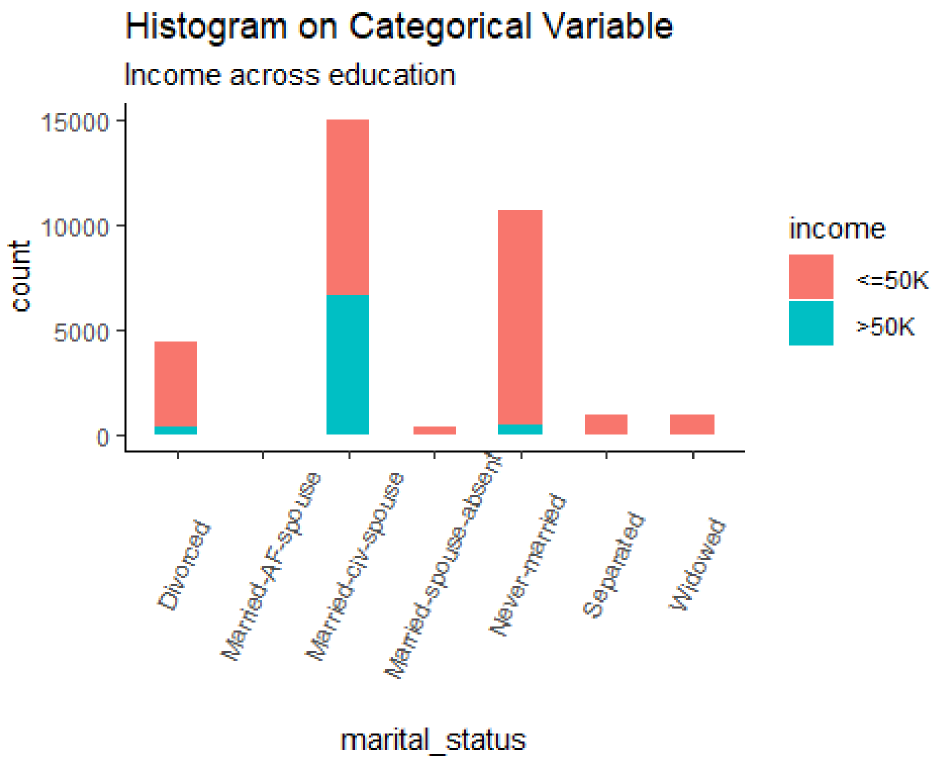
```r
levels(data$workclass)[1] <- 'Unknown'
```

```r
# combine into Sele-Employed job
data$workclass <- gsub('^Self-emp-inc', 'Self-Employed', data$workclass)
data$workclass <- gsub('^Self-emp-not-inc', 'Self-Employed', data$workclass)

# combine into Other/Unknown
data$workclass <- gsub('^Never-worked', 'Other', data$workclass)
data$workclass <- gsub('^Without-pay', 'Other', data$workclass)
data$workclass <- gsub('^Other', 'Others', data$workclass)
```

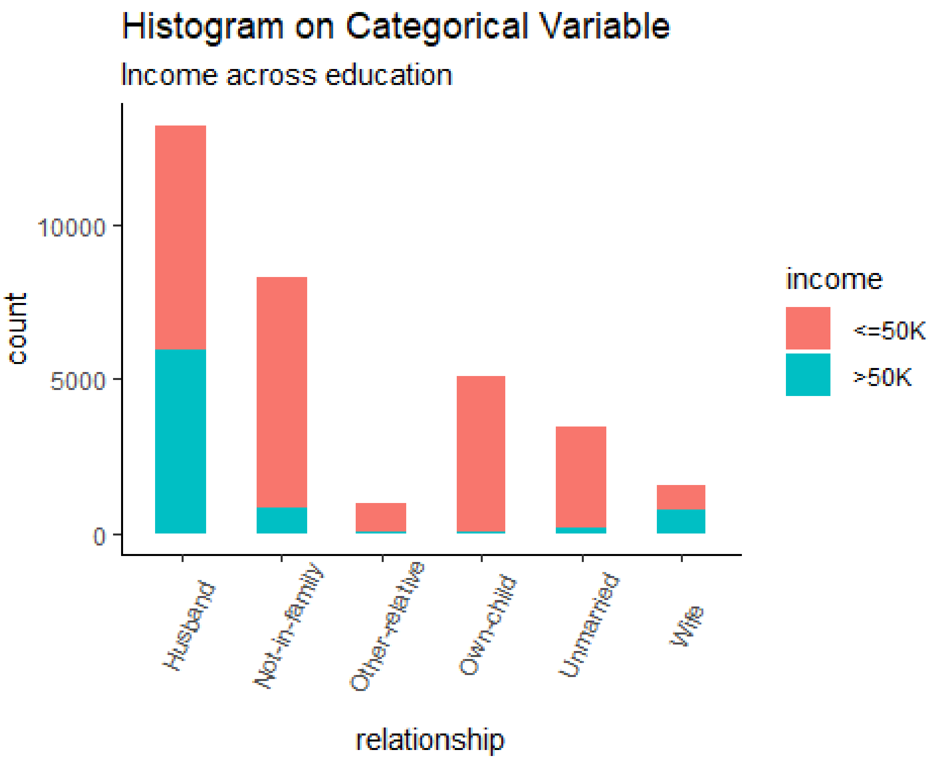
```r
data$workclass <- gsub('^Unknown', 'Other', data$workclass)

# combine into Government job
data$workclass <- gsub('^Federal-gov', 'Government', data$workclass)
data$workclass <- gsub('^Local-gov', 'Government', data$workclass)
data$workclass <- gsub('^State-gov', 'Government', data$workclass)


data$workclass <- as.factor(data$workclass)

data <- na.omit(data)

data$workclass <- gsub('[[:punct:]]', 'Other', data$workclass)
data$workclass <- as.factor(data$workclass)

summary(data$workclass)

##        Government             Other            Others           Private
##              4350              1836                21             22696
## SelfOtherEmployed
##              3657

theme_set(theme_classic())

# Histogram on a Categorical variable
g <- ggplot(data, aes(race))
g + geom_bar(aes(fill=income), width = 0.5) +
  theme(axis.text.x = element_text(angle=65, vjust=0.6)) +
  labs(title="Histogram on Categorical Variable",
       subtitle="Income across education")
```



```
summary(data$marital_status)

##              Divorced     Married-AF-spouse     Married-civ-spouse
##                  4443                    23                  14976
##  Married-spouse-absent        Never-married              Separated
##                   418                 10682                   1025
##               Widowed
##                   993

theme_set(theme_classic())

# Histogram on a Categorical variable
g <- ggplot(data, aes(marital_status))
g + geom_bar(aes(fill=income), width = 0.5) +
  theme(axis.text.x = element_text(angle=65, vjust=0.6)) +
  labs(title="Histogram on Categorical Variable",
       subtitle="Income across education")
```



```
theme_set(theme_classic())

# Histogram on a Categorical variable
g <- ggplot(data, aes(relationship))
g + geom_bar(aes(fill=income), width = 0.5) +
  theme(axis.text.x = element_text(angle=65, vjust=0.6)) +
  labs(title="Histogram on Categorical Variable",
       subtitle="Income across education")
```



```
data$native_country <- trimws(data$native_country)
summary(data$native_country)
```

```
##    Length     Class      Mode
##     32560 character character
```

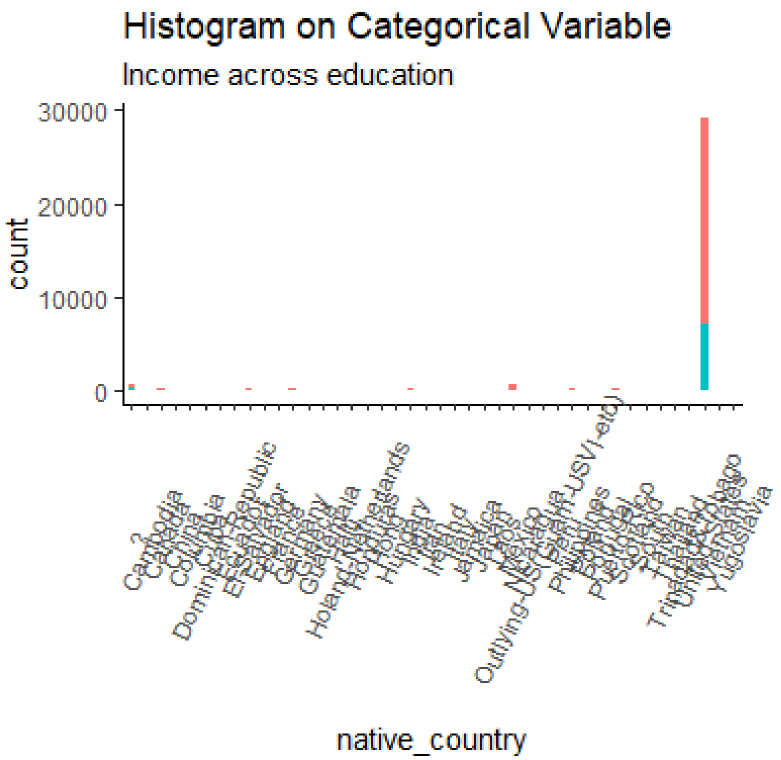
```
#Need to delete Outlying-US(Guam-USVI-etc)
data$native_country <- as.factor(data$native_country)

summary(data$native_country)
```

```
##                           ?                   Cambodia
##                         583                         19
##                      Canada                      China
##                         121                         75
##                    Columbia                       Cuba
##                          59                         95
##          Dominican-Republic                    Ecuador
##                          70                         28
##                 El-Salvador                    England
##                         106                         90
##                      France                    Germany
##                          29                        137
##                      Greece                  Guatemala
##                          29                         64
##                       Haiti         Holand-Netherlands
##                          44                          1
##                   Honduras                       Hong
##                         13                         20
##                    Hungary                      India
##                         13                        100
##                       Iran                    Ireland
##                         43                         24
##                      Italy                    Jamaica
##                         73                         81
##                      Japan                       Laos
##                         62                         18
##                     Mexico                  Nicaragua
##                        643                         34
## Outlying-US(Guam-USVI-etc)                       Peru
##                         14                         31
##                Philippines                     Poland
##                        198                         60
##                   Portugal                Puerto-Rico
##                         37                        114
##                   Scotland                      South
##                         12                         80
##                     Taiwan                   Thailand
##                         51                         18
##            Trinadad&Tobago              United-States
##                         19                      29169
##                    Vietnam                 Yugoslavia
##                         67                         16
```

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

```
data$native_country <- as.factor(data$native_country)
```

```
theme_set(theme_classic())

# Histogram on a Categorical variable
g <- ggplot(data, aes(native_country))
g + geom_bar(aes(fill=income), width = 0.5) +
  theme(axis.text.x = element_text(angle=65, vjust=0.6)) +
  labs(title="Histogram on Categorical Variable",
       subtitle="Income across education")
```


Histogram on Categorical Variable
Income across education
count
30000
20000
10000
0
income
🟥 <=50K
🟦 >50K
?
Cambodia
Canada
China
Columbia
Cuba
Dominican-Republic
Ecuador
El-Salvador
England
France
Germany
Greece
Guatemala
Haiti
Holand-Netherlands
Honduras
Hong
Hungary
India
Iran
Ireland
Italy
Jamaica
Japan
Laos
Mexico
Nicaragua
Outlying-US(Guam-USVI-etc)
Peru
Philippines
Poland
Portugal
Puerto-Rico
Scotland
South
Taiwan
Thailand
Trinadad&Tobago
United-States
Vietnam
Yugoslavia
native_country

```
```