HW3

March 11, 2020

[2]:

```
import warnings
warnings.filterwarnings('ignore')

import pandas as pd
import numpy as np
from plotnine import *
import statsmodels.api as sm


from sklearn.linear_model import LogisticRegression # Logistic Regression Model
from sklearn.preprocessing import StandardScaler #Z-score variables
from sklearn.metrics import accuracy_score, confusion_matrix

from sklearn.model_selection import train_test_split # simple TT split cv
from sklearn.model_selection import KFold # k-fold cv
from sklearn.model_selection import LeaveOneOut #LOO cv
from sklearn.model_selection import cross_val_score # cross validation metrics
from sklearn.model_selection import cross_val_predict # cross validation metrics
```

1 1) Explore Data

[3]:

```
data = pd.read_csv("https://raw.githubusercontent.com/cmparlettpelleriti/
 ↪CPSC392ParlettPelleriti/master/Data/GradAdmissions.csv")
```

[4]:

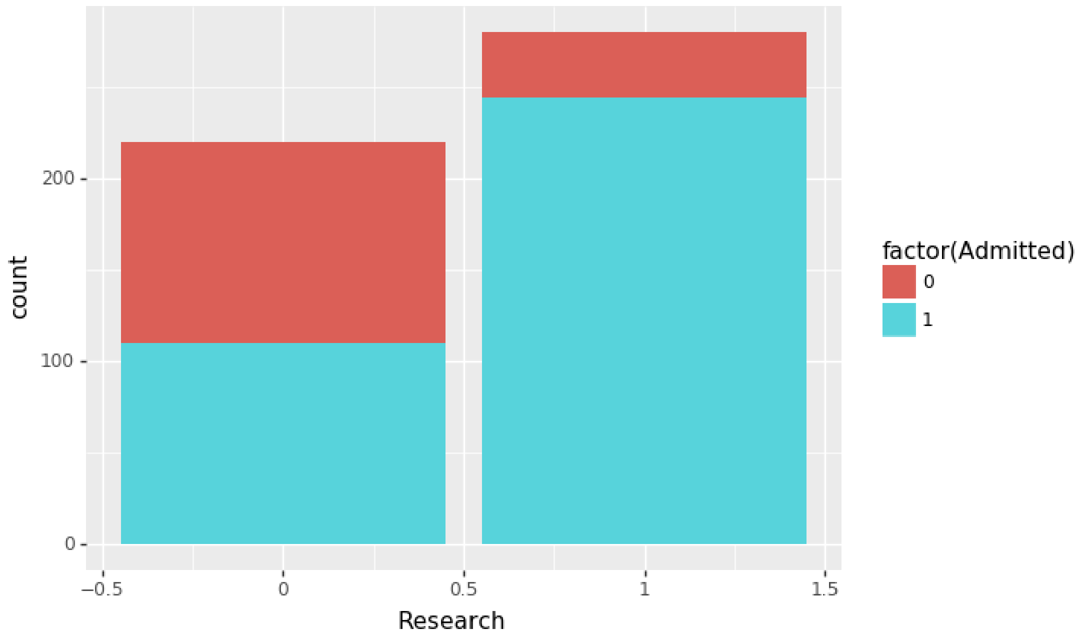
```
data.head()
```

[4]:

```
   Serial No.  GRE Score  TOEFL Score  University Rating  SOP  LOR   CGPA  \
0           1        337          118                  4  4.5   4.5  9.65
1           2        324          107                  4  4.0   4.5  8.87
2           3        316          104                  3  3.0   3.5  8.00
3           4        322          110                  3  3.5   2.5  8.67
4           5        314          103                  2  2.0   3.0  8.21

   Research  Admitted
0         1         1
1         1         1
```

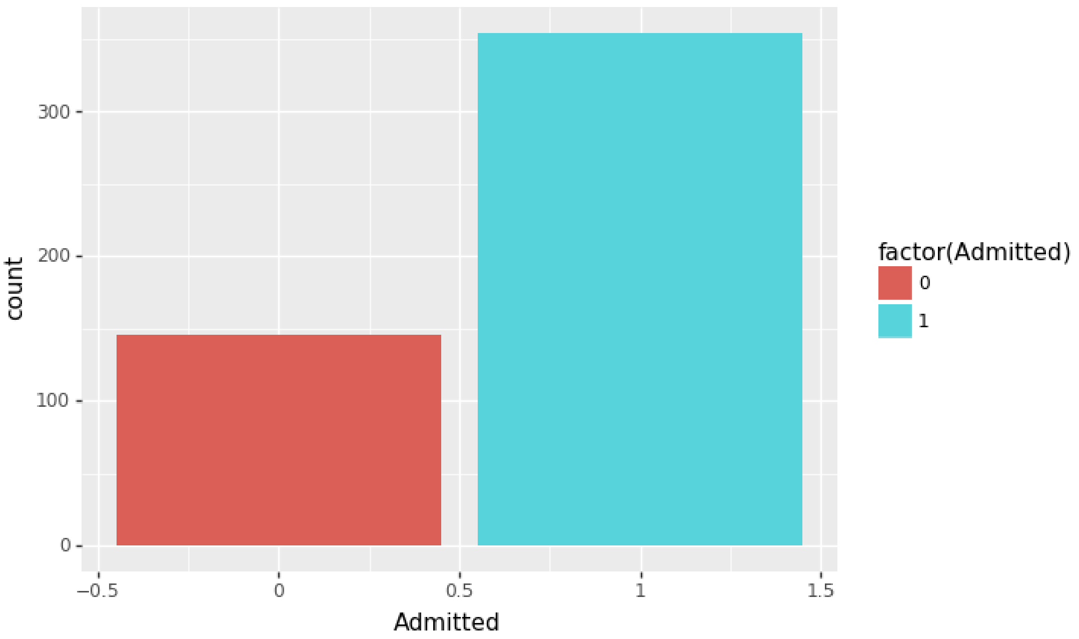
```
2           1           1
3           1           1
4           0           1
```

```
[24]: (ggplot(data, aes("Research")) +
          geom_bar(aes(fill = "factor(Admitted)")))
```



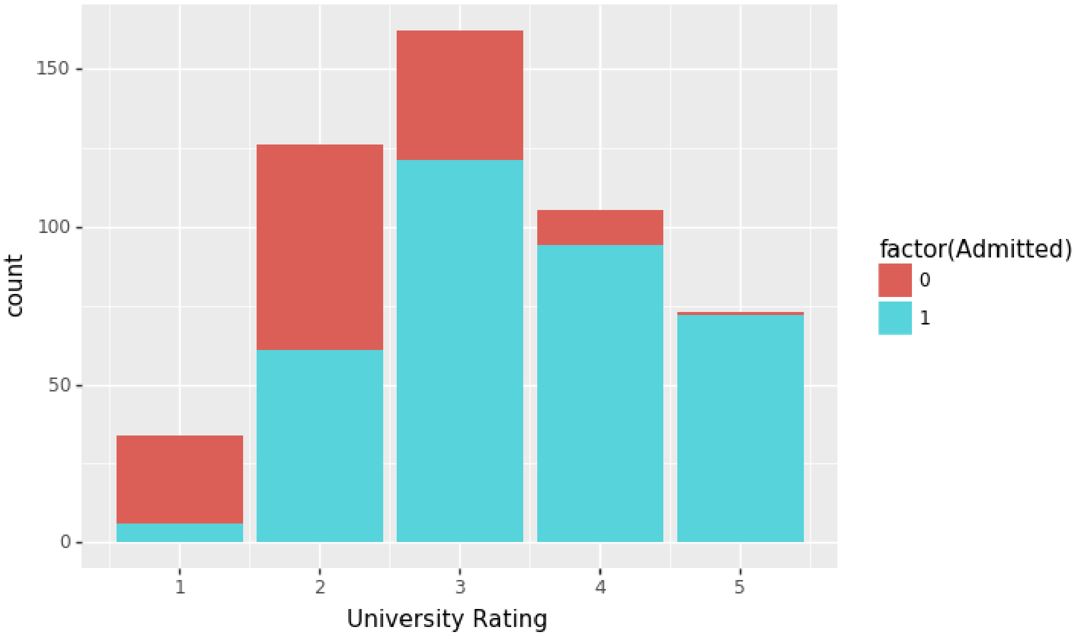
```
[24]: <ggplot: (304319461)>
```

```
[23]: (ggplot(data, aes("Admitted")) +
          geom_bar(aes(fill = "factor(Admitted)")))
```



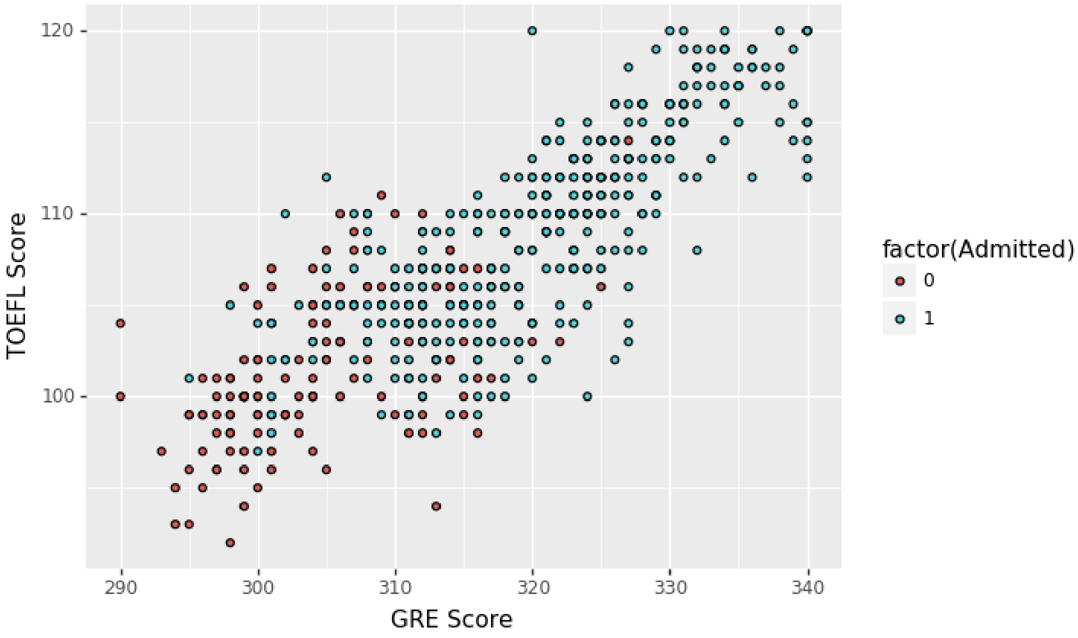
```
[23]: <ggplot: (304315257)>
```

```
[11]: (ggplot(data, aes("University Rating", fill = "factor(Admitted)")) +
          geom_bar())
```



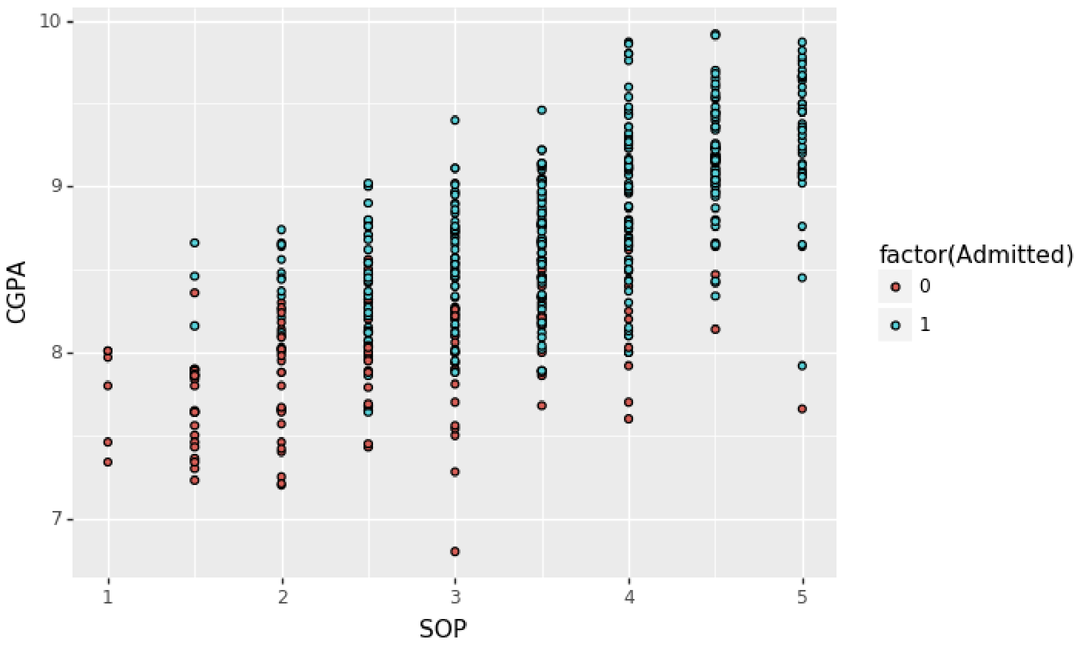
```
[11]: <ggplot: (304176441)>
```

```
[10]: (ggplot(data, aes("GRE Score", "TOEFL Score", fill = "factor(Admitted)")) +
          geom_point())

      # with a high TOEFL Score and a high GRE Score, a student is almost guarenteed␣
       ↪admission
```



```
[10]: <ggplot: (304095845)>
```

```
 [9]: (ggplot(data, aes("SOP", "CGPA", fill = "factor(Admitted)")) +
          geom_point())

      # with a high CGPA and a high SOP, a student is almost guarenteed admission
```



```
[9]: <ggplot: (274256861)>
```

2 2) Cross-validation and Standardization

```
[18]: X = data[["GRE Score","TOEFL Score","LOR ","SOP", "CGPA"]] # predictors
y = data["Admitted"] # outcome

# cross validation: creating test and training datasets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2) #data
X_train.head()

#standardization
zscore = StandardScaler()
zscore.fit(X_train)
Xz_train = zscore.transform(X_train)
Xz_test = zscore.transform(X_test)

# my created model
My_model = LogisticRegression() #create model
My_model.fit(Xz_train,y_train) #fit
predictedVals = My_model.predict(Xz_test) #predict

# prints accuracy of my model
accuracy_score(y_test,predictedVals)
```

[18]:
```
0.82
```

[19]:
```
# prints off confusion matrix
confusion_matrix(y_test,predictedVals)
```

[19]:
```
array([[15,  5],
       [13, 67]])
```

[ ]:
```
# my model was pretty accurate with an 0.82 accuracy score.
# it accurately predicted 82 (15+67) observations and inaccurately predicted 18␣
 ↪(5+13) observations.
```

[20]:
```
# create k-fold object
kf = KFold(n_splits = 5)
kf.split(X)

acc = []
lr = LogisticRegression()

for train_indices, test_indices in kf.split(X):
    # Get your train/test for this fold
    X_train = X.iloc[train_indices]
    X_test  = X.iloc[test_indices]
    y_train = y[train_indices]
    y_test  = y[test_indices]

    # model
    model = lr.fit(X_train, y_train)
    # record accuracy
    acc.append(accuracy_score(y_test, model.predict(X_test)))

#print overall acc
print(acc)
np.mean(acc)
```

```
[0.67, 0.84, 0.89, 0.84, 0.78]
```

[20]:
```
0.8039999999999999
```

[ ]:
```
# this shows the accuracy of five different instances of the model, 0.67 being␣
 ↪the worst and 0.89 being the best.
# Moving forward I would use this model beacause it averages about a 0.80␣
 ↪accuracy score.
# "GRE Score","TOEFL Score","LOR ","SOP", and "CGPA" are then great variables␣
 ↪for predicting whether a student will be admitted.
```