

D209 Data Mining 1 - NVM2 - Predictive Analysis

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Part I: Research Question

- A. Describe the purpose of this data mining report by doing the following:
1. Propose one question relevant to a real-world organizational situation that you will answer using one of the following prediction methods:
 - decision trees
 - random forests
 - advanced regression (i.e., lasso or ridge regression)
 2. Define one goal of the data analysis. Ensure that your goal is reasonable within the scope of the scenario and is represented in the available data.

A1. Proposal of Question: Which customers are at high risk of churn? And, which customer features/variables are most significant to churn?

A2. Defined Goal: Stakeholders in the company will benefit by knowing, with some measure of confidence, which customers are at highest risk of churn because this will provide weight for decisions in marketing improved services to customers with these characteristics and past user experiences.

Part II: Method Justification

- B. Explain the reasons for your chosen prediction method from part A1 by doing the following:
1. Explain how the prediction method you chose analyzes the selected data set. Include expected outcomes.
 2. Summarize one assumption of the chosen prediction method.
 3. List the packages or libraries you have chosen for Python or R, and justify how each item on the list supports the analysis.

B1. Explanation of Prediction Method: Explain how the prediction method you chose analyzes the selected data set. Include expected outcomes.

B2. Summary of Method Assumption: Summarize one assumption of the chosen prediction method.

B3. Packages or Libraries List: List the packages or libraries you have chosen for Python or R, and justify how each item on the list supports the analysis.

Standard imports

```
[ ]: # Standard data science imports
import numpy as np
import pandas as pd
from pandas import Series, DataFrame

# Visualization libraries
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline

# Statistics packages
import pylab
from pylab import rcParams
import statsmodels.api as sm
import statistics
from scipy import stats

# Scikit-learn
import sklearn
from sklearn import preprocessing
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
from sklearn import metrics
from sklearn.metrics import classification_report

# Import chisquare from SciPy.stats
from scipy.stats import chisquare
from scipy.stats import chi2_contingency
```

Change color of Matplotlib font!!!

```
[ ]: import matplotlib as mpl

COLOR = 'aquamarine'
mpl.rcParams['text.color'] = COLOR
mpl.rcParams['axes.labelcolor'] = COLOR
```

```
mpl.rcParams['xtick.color'] = COLOR
mpl.rcParams['ytick.color'] = COLOR
```

Ignore Warning Code

```
[ ]: import warnings
     warnings.filterwarnings('ignore')

[ ]: # Load data set into Pandas dataframe
     df = pd.read_csv('Data/churn_clean.csv')

[ ]: # Rename last 8 survey columns for better description of variables
     df.rename(columns = {'Item1': 'TimelyResponse',
                          'Item2': 'Fixes',
                          'Item3': 'Replacements',
                          'Item4': 'Reliability',
                          'Item5': 'Options',
                          'Item6': 'Respectfulness',
                          'Item7': 'Courteous',
                          'Item8': 'Listening'},
               inplace=True)
```

Part III: Data Preparation

C. Perform data preparation for the chosen data set by doing the following:

1. Describe one data preprocessing goal relevant to the prediction method from part A1.
2. Identify the initial data set variables that you will use to perform the analysis for the prediction question from part A1, and group each variable as continuous or categorical.
3. Explain the steps used to prepare the data for the analysis. Identify the code segment for each step.
4. Provide a copy of the cleaned data set.

C1. Data Preprocessing: Describe one data preprocessing goal relevant to the prediction method from part A1.

C2. Dataset Variables: Identify the initial data set variables that you will use to perform the analysis for the prediction question from part A1, and group each variable as continuous or categorical.

C3. Steps for Analysis: Explain the steps used to prepare the data for the analysis. Identify the code segment for each step.

C4. Cleaned Dataset: Provide a copy of the cleaned data set.

```
[ ]: # Create histograms of continuous & categorical variables
df[['MonthlyCharge', 'Bandwidth_GB_Year', 'TimelyResponse', 'Courteous']].hist()
plt.savefig('churn_pyplot.jpg')
plt.tight_layout();

[ ]: # Create Seaborn boxplots for continuous & categorical variables
sns.boxplot('MonthlyCharge', data = df)
plt.show()

[ ]: sns.boxplot('Bandwidth_GB_Year', data = df)
plt.show()

[ ]: sns.boxplot('TimelyResponse', data = df)
plt.show()

[ ]: sns.boxplot('Courteous', data = df)
plt.show()
```

Part IV: Analysis

D. Perform the data analysis and report on the results by doing the following:

1. Split the data into training and test data sets and provide the file(s).
2. Describe the analysis technique you used to appropriately analyze the data. Include screenshots of the intermediate calculations you performed.
3. Provide the code used to perform the prediction analysis from part D2.

D1. Splitting the Data Split the data into training and test data sets and provide the file(s).

D2. Output & Intermediate Calculations Describe the analysis technique you used to appropriately analyze the data. Include screenshots of the intermediate calculations you performed.

D3. Code Execution Provide the code used to perform the prediction analysis from part D2.

Part V: Data Summary & Implications

E. Summarize your data analysis by doing the following:

1. Explain the accuracy and the mean squared error (MSE) of your prediction model.
2. Discuss the results and implications of your prediction analysis.
3. Discuss one limitation of your data analysis.
4. Recommend a course of action for the real-world organizational situation from part A1 based on your results and implications discussed in part E2.

E1. Accuracy & MSE Explain the accuracy and the mean squared error (MSE) of your prediction model.

E2. Results & Implications Discuss the results and implications of your prediction analysis.

E3. Limitation Discuss one limitation of your data analysis.

E4. Course of Action Recommend a course of action for the real-world organizational situation from part A1 based on your results and implications discussed in part E2.

Part VI: Demonstration

F. Provide a Panopto video recording that includes all of the following elements:

- a demonstration of the functionality of the code used for the analysis
- an identification of the version of the programming environment
- a comparison of the two multiple regression models you used in your analysis
- an interpretation of the coefficients.

F. Video link

G. Sources for Third-Party Code GeeksForGeeks. (2019, July 4). Python | Visualize missing values (NaN) values using Missingno Library. GeeksForGeeks. <https://www.geeksforgeeks.org/python-visualize-missing-values-nan-values-using-missingno-library/>

H. Sources CBTNuggets. (2018, September 20). Why Data Scientists Love Python. <https://www.cbtcnuggets.com/blog/technology/data/why-data-scientists-love-python>
Massaron, L. & Boschetti, A. (2016). Regression Analysis with Python. Packt Publishing.

```
[ ]: !wget -nc https://raw.githubusercontent.com/brpy/colab-pdf/master/colab_pdf.py
from colab_pdf import colab_pdf
colab_pdf('D209 Data Mining 1 - NVM2 - Predictive Analysis.ipynb')
```

```
--2021-08-06 15:02:26-- https://raw.githubusercontent.com/brpy/colab-
pdf/master/colab_pdf.py
```

```
Resolving raw.githubusercontent.com (raw.githubusercontent.com)...
```

```
185.199.109.133, 185.199.110.133, 185.199.108.133, ...
```

```
Connecting to raw.githubusercontent.com
```

```
(raw.githubusercontent.com)|185.199.109.133|:443... connected.
```

```
HTTP request sent, awaiting response... 200 OK
```

```
Length: 1864 (1.8K) [text/plain]
```

```
Saving to: colab_pdf.py
```

```
colab_pdf.py          100%[=====>]    1.82K  --.-KB/s    in 0s
```

```
2021-08-06 15:02:26 (30.9 MB/s) - colab_pdf.py saved [1864/1864]
```

```
Mounted at /content/drive/
```

WARNING: apt does not have a stable CLI interface. Use with caution in scripts.

WARNING: apt does not have a stable CLI interface. Use with caution in scripts.

Extracting templates from packages: 100%