Data Science: Healthcare Persistency of a drug (Group Project)

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Team Members

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Agenda

- Executive Summary
- Problem Statement
- Approach
- EDA
- Model Development
- Model Selection
- Model Evaluation
- Conclusion

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Executive Summary

ABC company also one of pharmaceutical companies, wants to know how long a medicine will last in a patient's system (persistency of a drug). Based on prescription data, the ABC corporation needs to determine whether a patient is persistent or not. ABC pharma would manufacture medicines in that number based on the persistency count so that they could operate their firm effectively and avoid the risks of NTM infections.

ML Problem:

With an objective to gather insights on the factors that are impacting the persistency, build a classification for the given dataset

Target Variable: Persistency_Flag

Problem Description

ABC is a pharmaceutical business that wants to know the persistency of a drug after a physician has prescribed it for a patient. This company has approached an analytics firm to automate the identifying procedure. This analytics firm has entrusted our team with the task of developing a solution to automate the persistence of a medicine for the client ABC.

Business Understanding

One of the long-lasting business issues in the world of pharmaceutical companies is the persistency of drugs which can significantly affect the outcome of medical treatments. One of the important factors that is related to persistency is the adherence of the patient to the prescribed regimens, meaning if the patient is committed to the prescribed regimens or not. There is a lot of information about Non-Tuberculous Mycobacterial (NTM) infections. In fact, related studies show that around 50%-60% of the patients with different illnesses in US miss doses, take the wrong doses, or drop off treatment in the first year. Additionally, the illness, either chronic or acute can be related to the adherence and persistency of drugs.

Project's Steps

- Problem understanding
- Data Understanding
- Data Cleaning and Feature engineering
- Model Development
- Model Selection
- Model Evaluation
- Report the accuracy, precision and recall of both the class of target variable
- Report ROC-AUC as well
- Deploy the model
- Explain the challenges and model selection

Methodologies

- Data was taken from github and analysed
- Problem understanding
- Data Understanding
- Data Cleaning and Feature engineering
- Model Development
- Model Selection
- Model Evaluation

Data Intake Report

- Name: Healthcare – Data Science Report date: 25th April 2021
- Data storage location: https://github.com/Khanhbao8695/HealthCar_DS2021
- Total number of files 1
- Total number of features 26
- Base format of the file .xlsx
- Size of the data 898 KB

Data Cleaning

- Checking Missing Value/ NAN / Null Data
- Checking Outliers
- Data Wrangling , Transformation and Standardization

Analyzing dependency of variable (Before Transformation)

Non-Persistent : 62.35 %
Persistent : 37.65 %

The analysis showed more non persistence of drugs than persistence

Missing Values

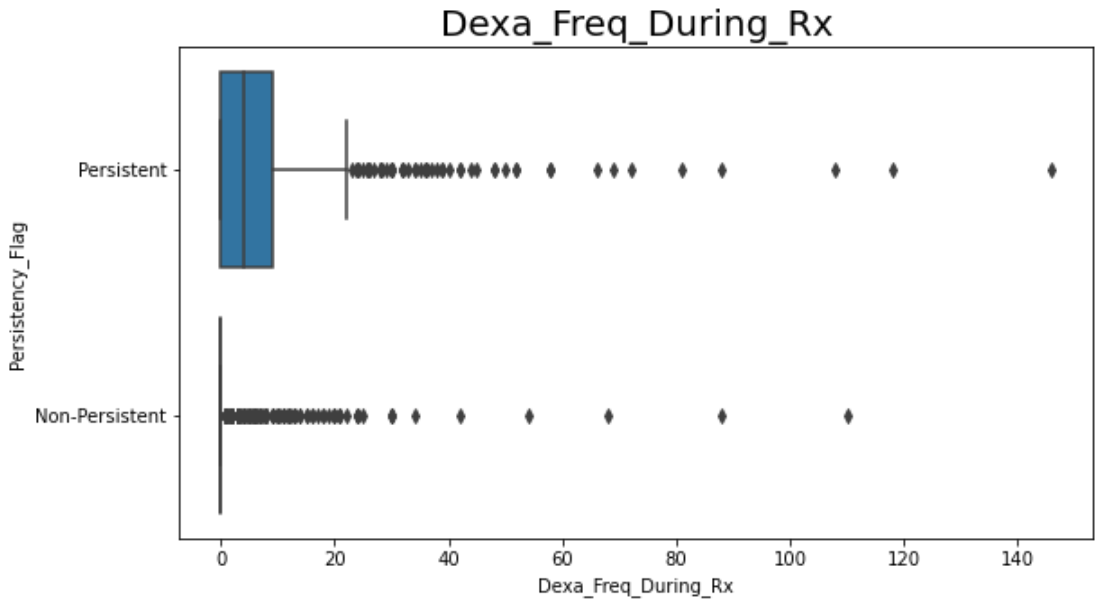
```
df.isnull().sum()
```

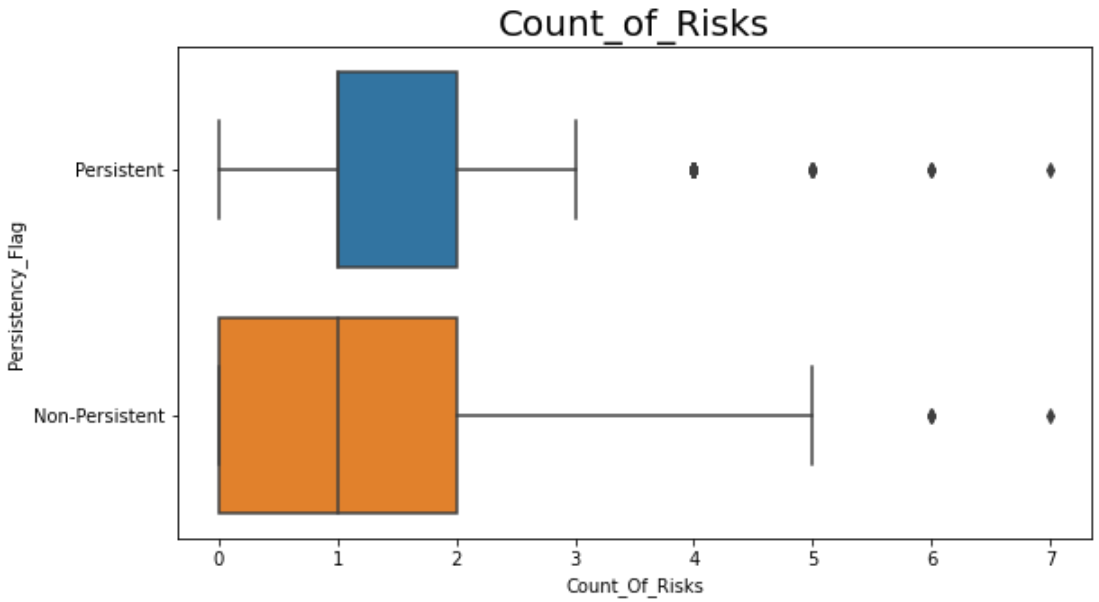
No missing values were found

```
for col in df.columns:
    pct_missing = np.mean(df[col].isnull())
    print('{} - {}'.format(col,pct_missing))
```

```
Ptid - 0.0
Persistency_Flag - 0.0
Gender - 0.0
Race - 0.0
Ethnicity - 0.0
Region - 0.0
Age_Bucket - 0.0
Ntm_Speciality - 0.0
Ntm_Specialist_Flag - 0.0
Ntm_Speciality_Bucket - 0.0
Gluco_Record_Prior_Ntm - 0.0
Gluco_Record_During_Rx - 0.0
Dexa_Freq_During_Rx - 0.0
Dexa_During_Rx - 0.0
Frag_Frac_Prior_Ntm - 0.0
Frag_Frac_During_Rx - 0.0
Risk_Segment_Prior_Ntm - 0.0
Tscore_Bucket_Prior_Ntm - 0.0
Risk_Segment_During_Rx - 0.0
Tscore_Bucket_During_Rx - 0.0
Change_T_Score - 0.0
Change_Risk_Segment - 0.0
Adherent_Flag - 0.0
Idn_Indicator - 0.0
Injectable_Experience_During_Rx - 0.0
```

Checking Outliers





As we can see on these graphs, it is clearly to conclude that both Dexa_Freq_During_Rx and Count_of_Risks variables have outliers. Therefore, we will implement solutions to deal with this issue

Data Transformation to resolve outliers

- Our approach to deal with the skewness and outliers for these variables is using IQR Score. To remove outliers, this approach uses the IQR values calculated before. Anything outside of the range of (Q1 - 1.5 IQR) and (Q3 + 1.5 IQR) is considered an outlier and should be eliminated.
- In this project, for Dexa_Freq_During_Rx and Count_of_Risks, we will remove any data outside of the range of (Q1 - 1.5 IQR) and (Q3 + 1.5 IQR) or two whiskers.

- For the Old Shape (3424,69) for both of Count of Risk" and “Dexa Freq During Rx" variable but after removed the outliers with this method, the new shape only (2964,69), which remove 460 data outside of the range of (Q1 - 1.5 IQR) and (Q3 + 1.5 IQR).

LABEL Encoding for categorical variables

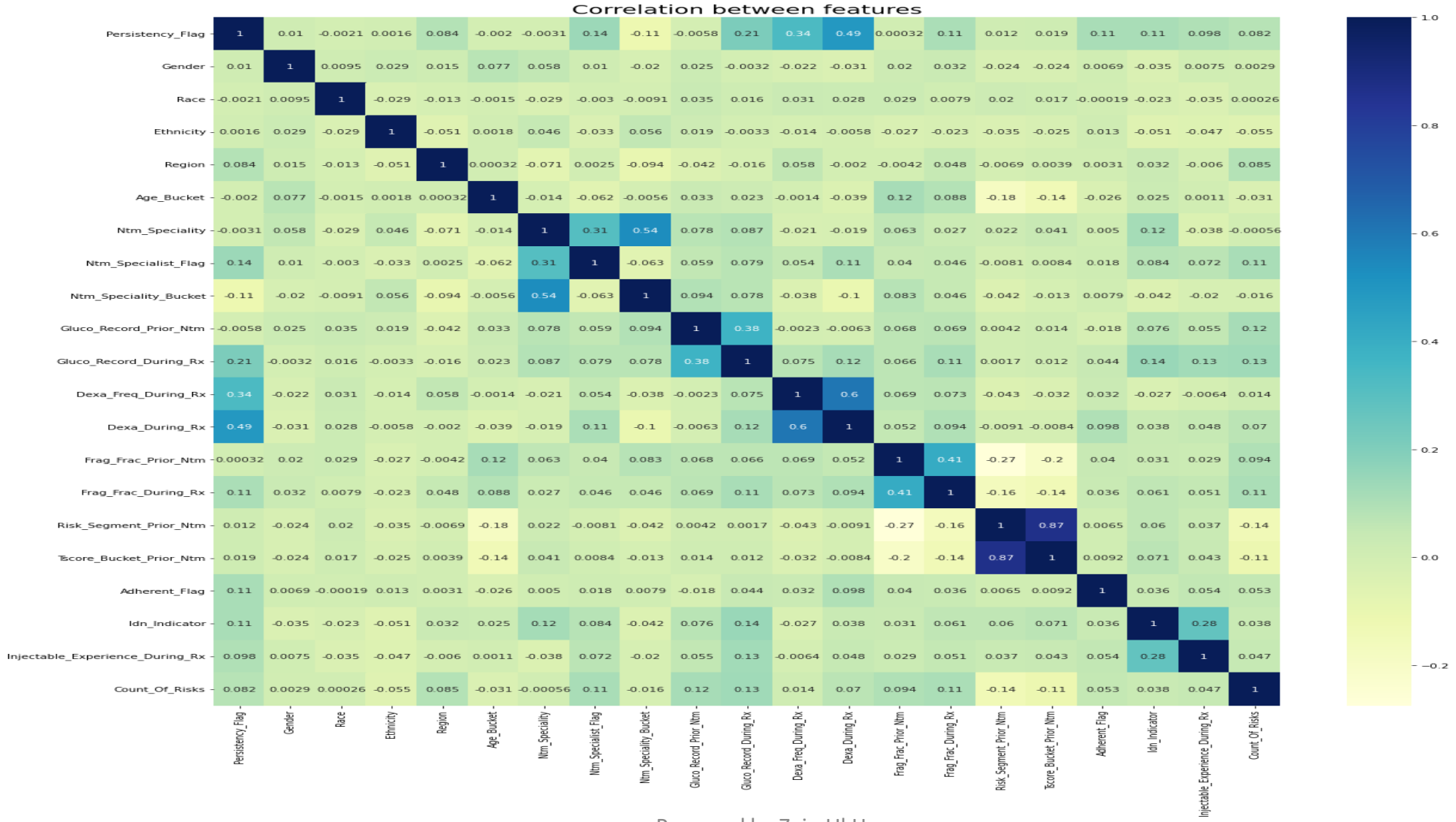
- We need to pre-process our categorical data from words to number to make it easier for the computer to understands. To do this we will use LabelEncoder() provided by sklearn. Basically, it will transform a categorical column from this (example to describe this approach):

Gender	Race
Male	Asian
Female	Other/Unknown
Male	Caucasian

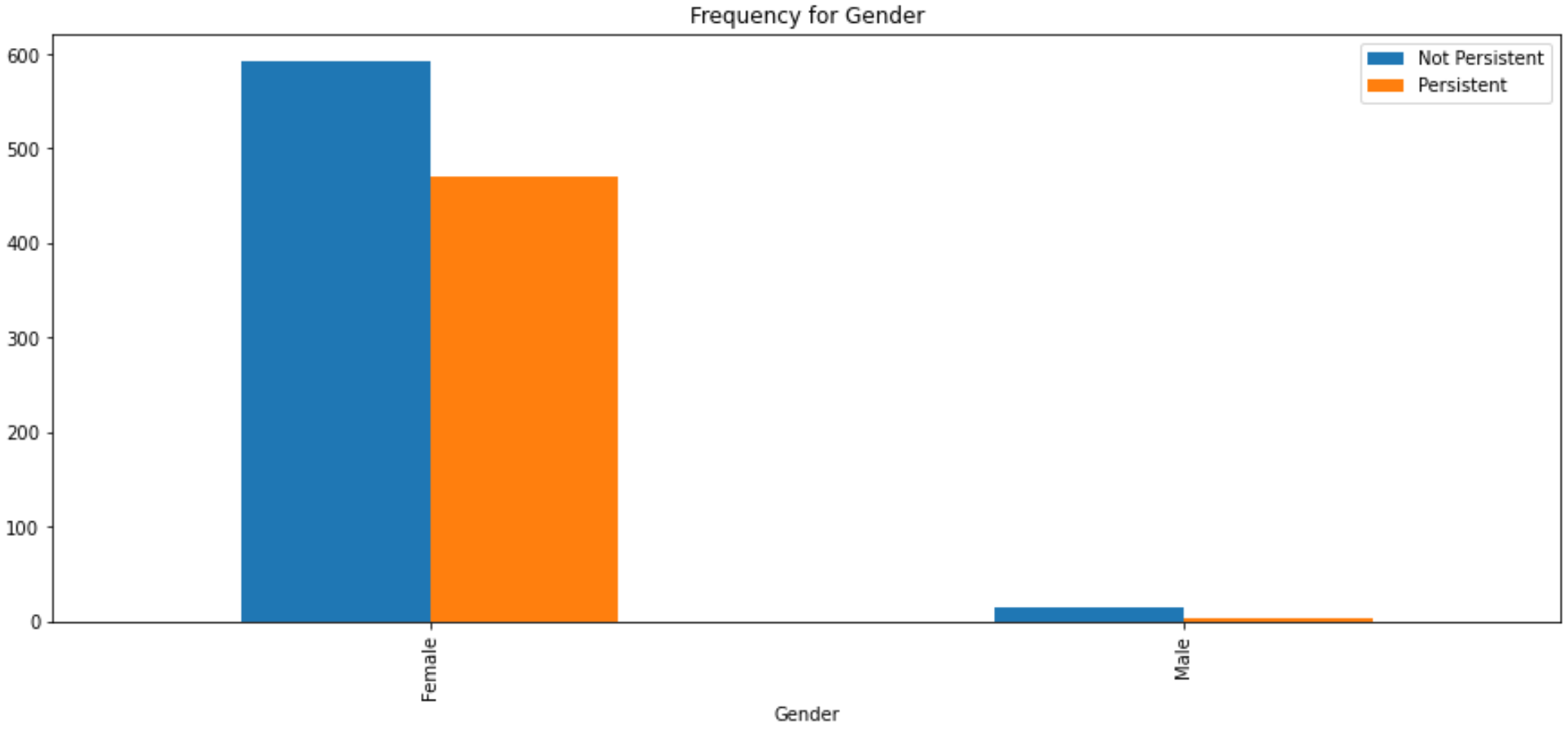
...into something like this... For example, Male will be 1 and Female will be 0

Gender	Race
1	1
0	3
1	2

EDA (1): Correlation after transformation

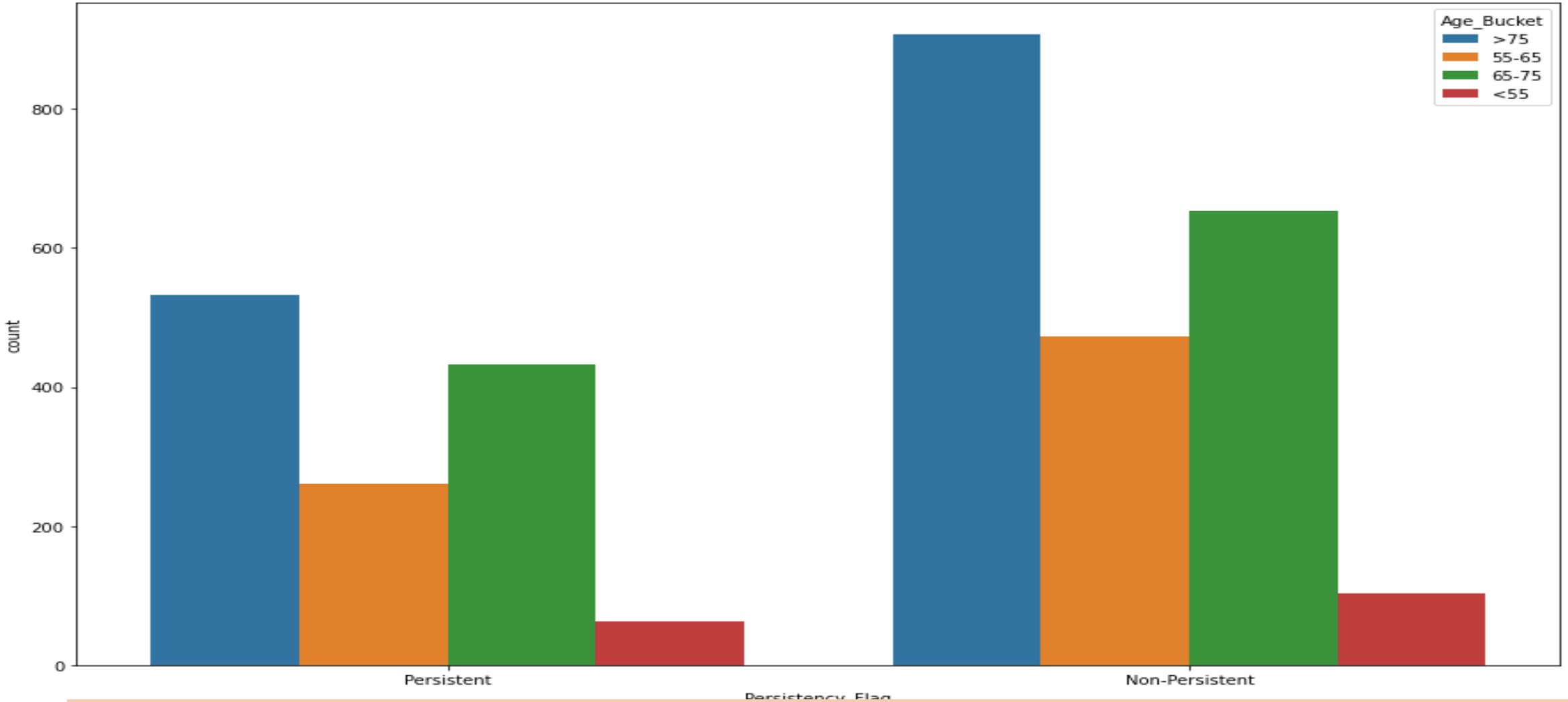


EDA (2): Gender



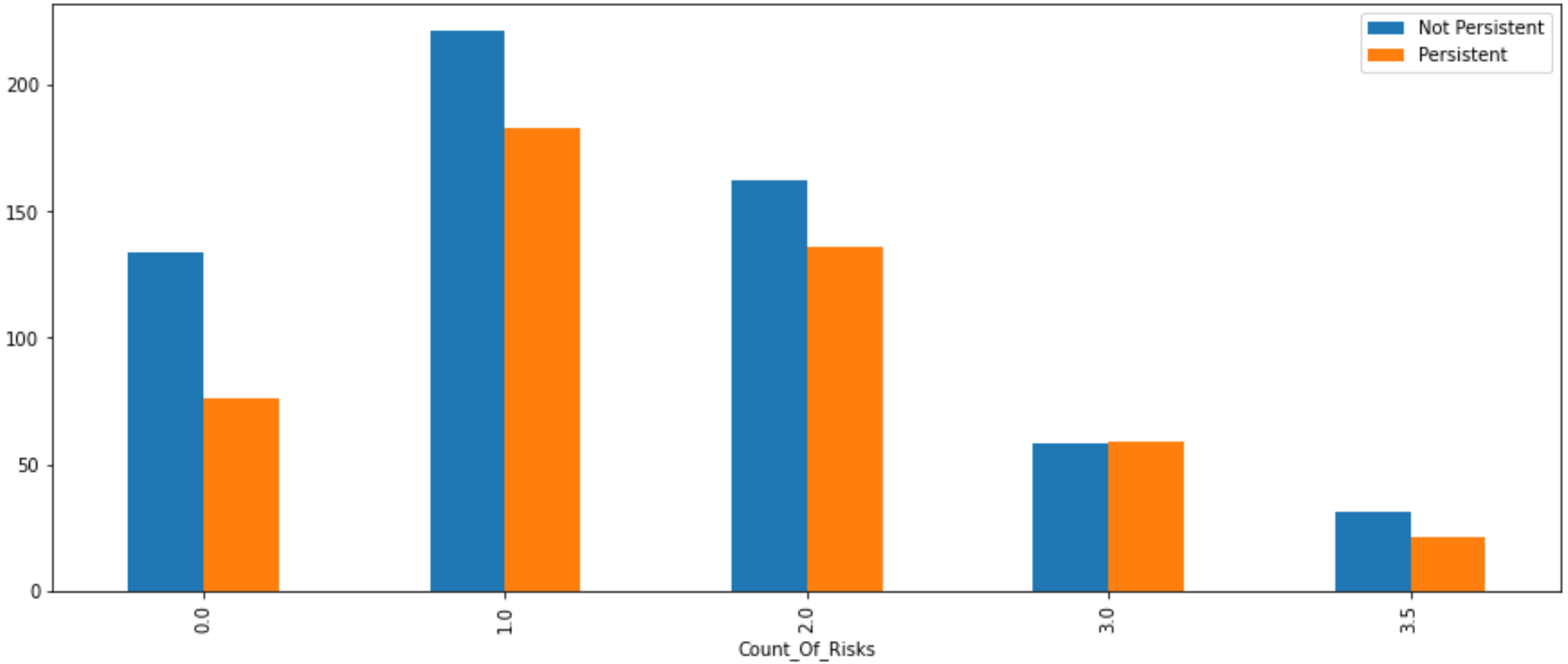
It shows that females are most persistent with drug compliance

EDA (3): Age



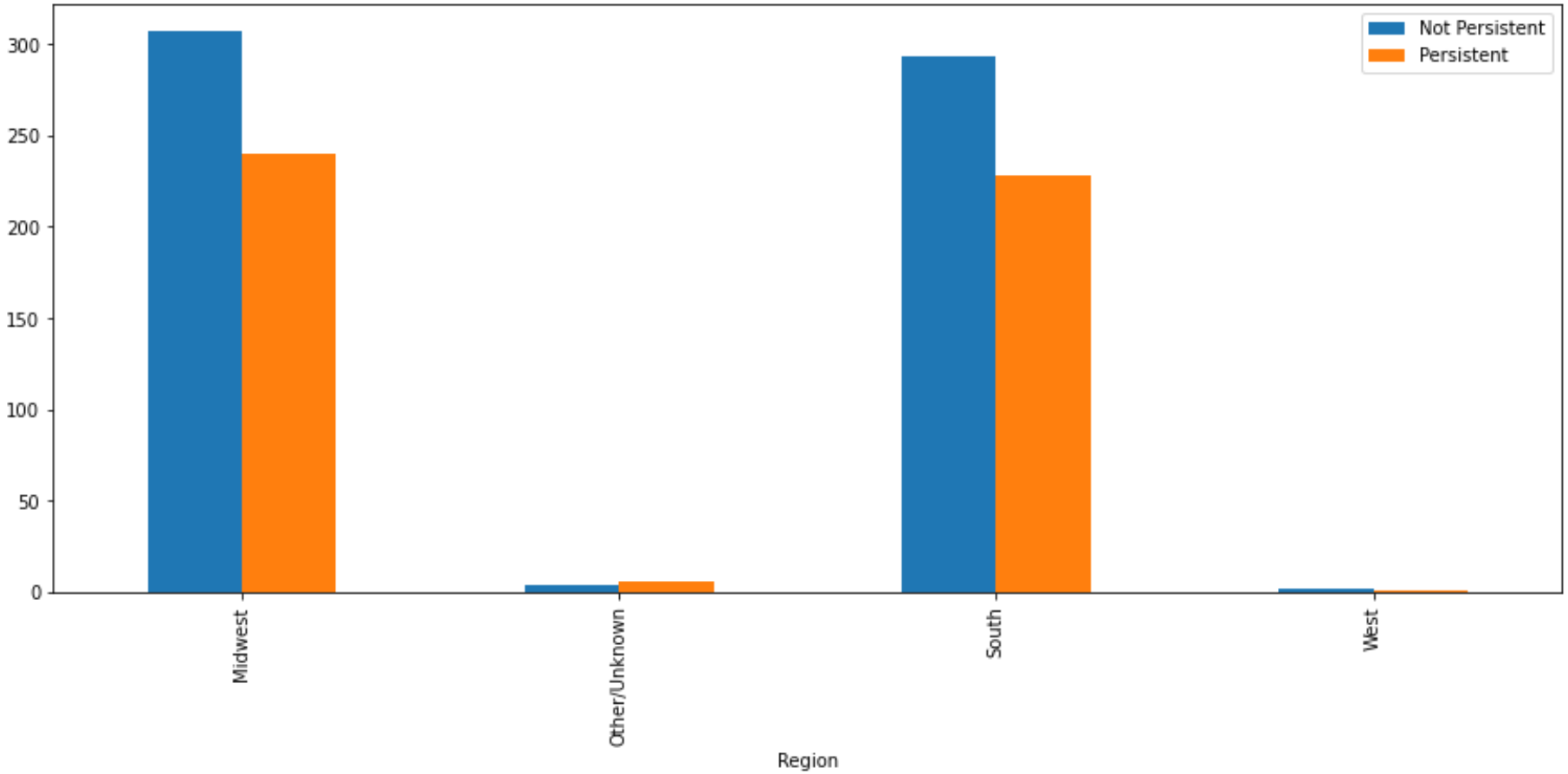
Group of people under 55 years old tend to have higher persistent compared to other groups

EDA (4): Number of Risks and Persistent with drugs



It shows that the number of risk arises when patients are not persistent with their drugs

EDA (5): Regions and Persistent with drugs



South and Midwest Regions have both higher Persistent and Non-Persistent Drugs

Model Suggestion

- We will develop four different classification models:
  - Linear Models: Logistic Regression
  - Model for Ensemble: XGBoost Classifier
  - Model for boosting: AdaBoost Classifier
  - Other models: SVM

Thank You

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