

CoverMyMeds Challenge

MEDWISE : Help you get the meds you need!

Team Gold :

Kavya Mukundan, Siqi Sun, Ruqiah Muhammad



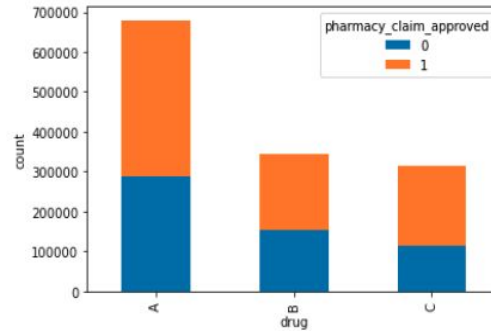
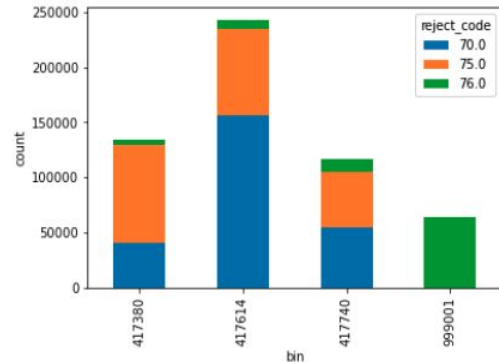
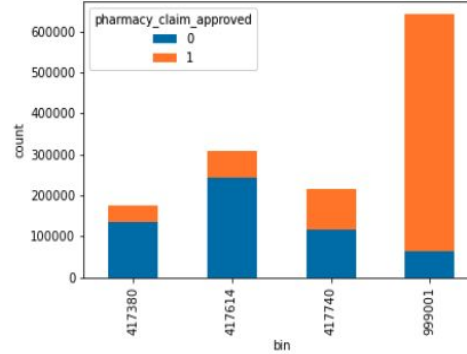
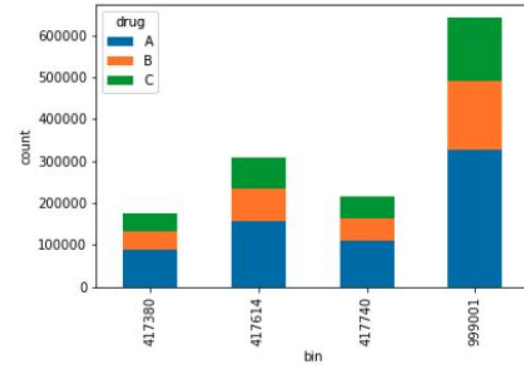
<https://github.com/alohasiqi/CMM>

Introduction

Our project tries to answer the following questions using the data provided by CoverMyMeds :

- Understand the formulary of each payer using pharmacy claim data
- Create an app to
 - Explore data
 - Predict claim approval
 - Predict prior authorization (PA) approval
 - Predict future PA volume

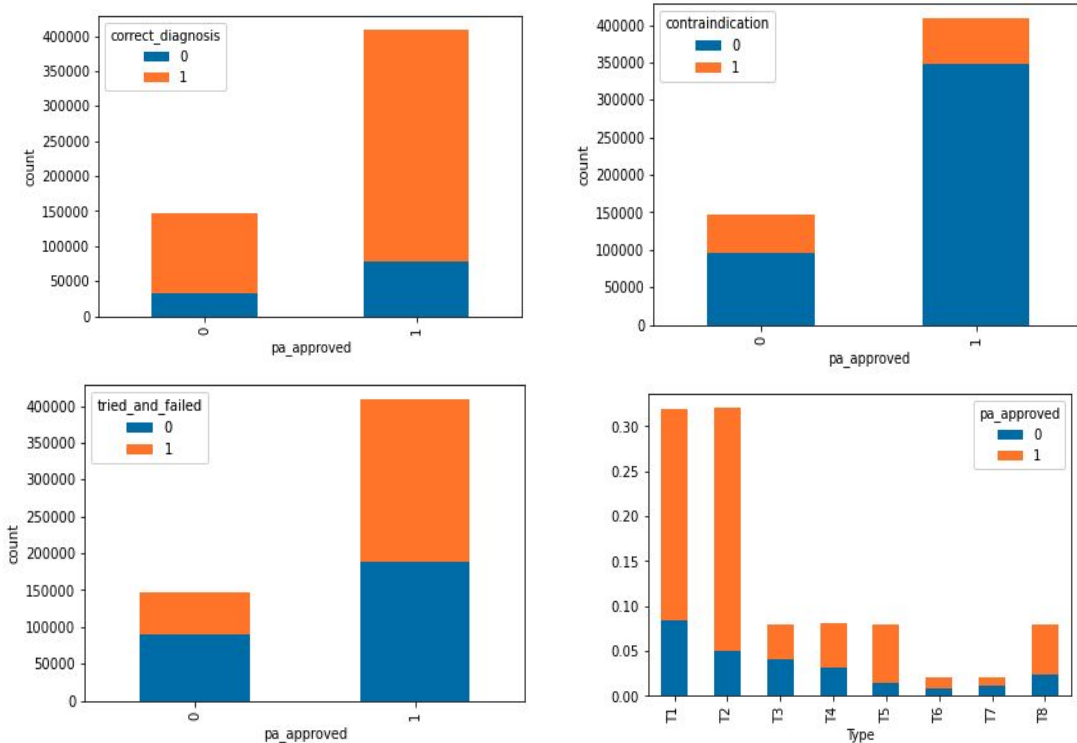
EDA for Claims Data



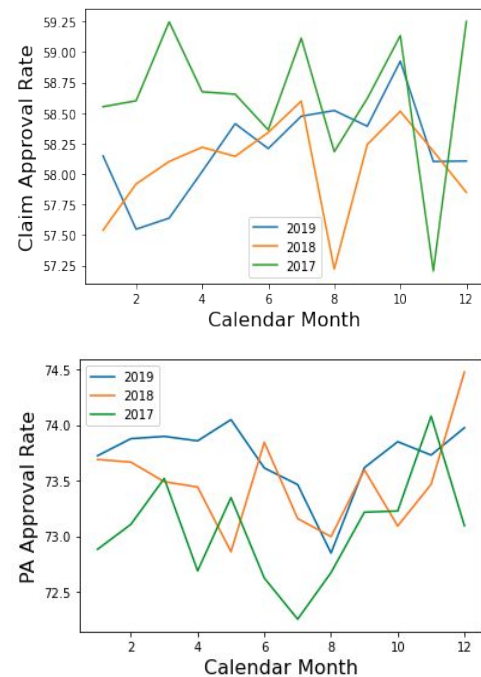
Formulary for each Company			
Bin	Drugs in Formulary	Rejection code (75 or 76)	Drugs not in Formulary (70)
417380	A B	Needs PA Exceeds limit	C
417614	B C	Needs PA Exceeds limit	A
417740	C A	Needs PA Exceeds limit	B
999001	A B C	Exceeds limit Exceeds limit Exceeds limit	

EDA for Prior Authorization Data & Time Series

Prior Authorization:



Time Series:



Model Claim Approval

Binary classification problem : Implemented **logistic regression** model to predict probability of claim approval

X: Drug, payer (One Hot encoding for categorical variables)

y: Pharmacy_claim_approved - 1 : claim approved, 0 : claim rejected

Class weights : to balance classes

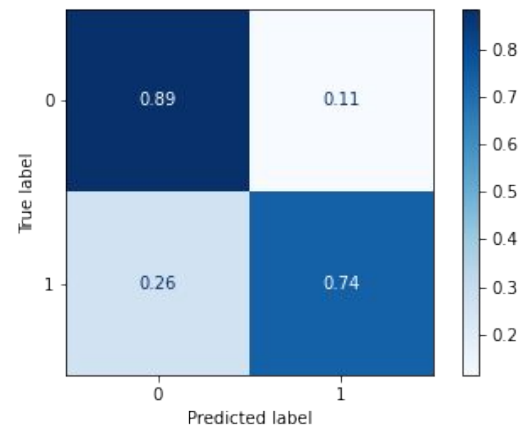
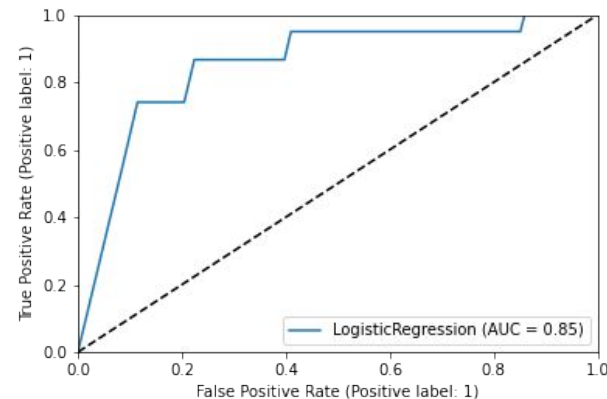
(**W_j** = number of samples / (number of classes x number of samples in class j))

W_0 : 1.2 , W_1 : 0.86

Train - test split : 75% training data , 25% test data

Average **5-fold cross-validation** scores : **ROC_AUC score : 0.852, F1-score : 0.812**

Test ROC_AUC score : 0.81 Test F1 score : 0.81



Model PA approval

Implemented logistic regression model to predict probability of PA approval.

X : diagnosis (correct_diagnosis + tried_and_failed + contraindication) ,
drug_payer (drug + payer), one hot encoding for categorical variables

y : PA_approved - 0 : pa_rejected , 1 : pa_approved

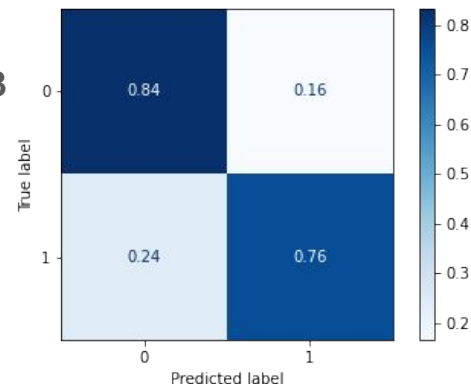
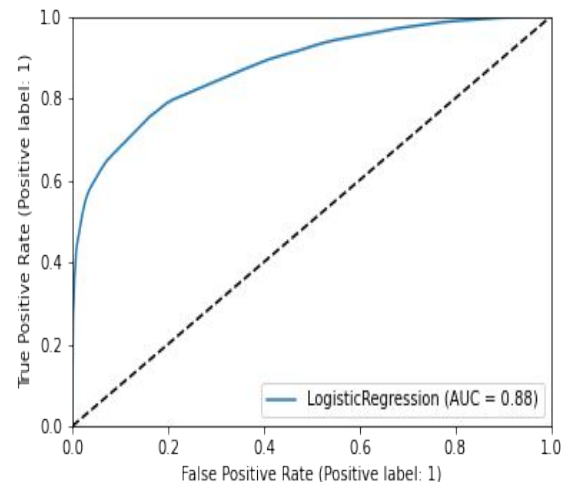
Class weights : W_0 : 1.88 , W_1 : 0.68

Train - test split : 75% training data , 25% test data

Average 5-fold cross-validation scores : **ROC_AUC score : 0.88, F1-score : 0.83**

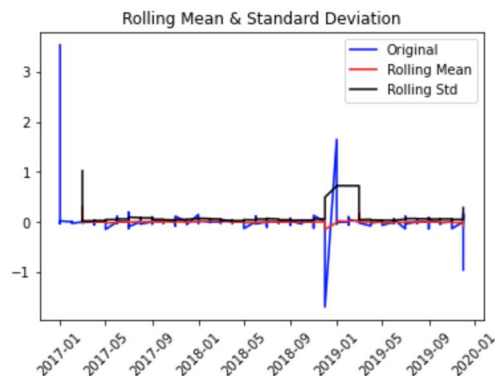
Test ROC_AUC score : **0.8** Test F1 score : **0.83**

The coefficients of logistic regression may be interpreted in terms of odds ratios to predict the odds of PA approval given certain conditions!

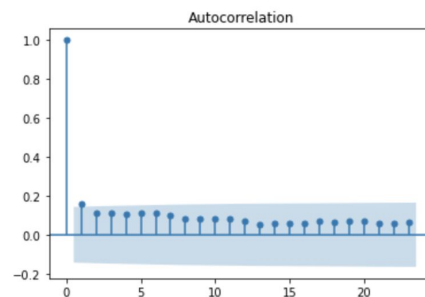
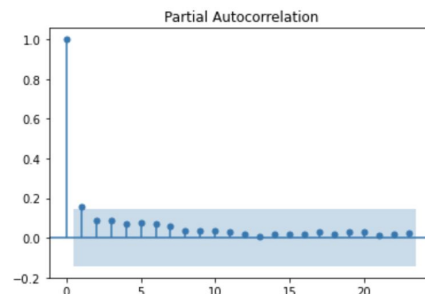


Model Time Series

- Data pre-processing
 - Extract weekly or monthly data
 - Log conversion and time shifting
 - Check by rolling mean and ADF statistic



ADF Statistic: -9.534923982443724
p-value: $2.825479998478509e-16$
Critical Values:
1%: -3.4668001583460613
5%: -2.877552336674317
10%: -2.5753075498128246



- Model building
 - ARIMA for monthly data
 - SARIMAX for weekly data



Time Series Modeling

- Data pre-processing
 - Extract weekly or monthly data
 - Perform log conversion and time shifting
 - Check rolling mean and ADF statistic
- Model building
 - ARIMA for monthly data
 - SARIMAX for weekly data
- Future directions
 - Calculate other loss functions to predict accuracy
 - Expand the covariates include in the model

App

MEDWISE: HELP GET THE MEDS YOU NEED

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WELCOME!

This project was performed as part of the Erdős Institute's Spring 2021 Data Science Bootcamp.

The data were provided by CoverMyMeds.

Created by Kavya Mukundan, Siqi Sun, Ruqiah Muhammad.

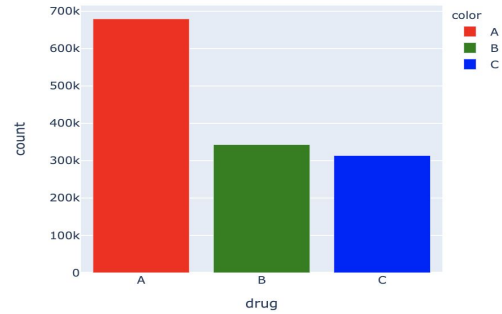


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Which data would you like to explore?

☒ Claims Data☐ Prior Authorization Data

Select a feature below to see its frequency.

☐ bin ☒ drug ☐ reject_code ☐ pharmacy_claim_approved[Home](#)[EDA](#)[PA approval prediction](#)[PA volume prediction](#)

Select prediction mode

☒ week ☐ month

Select prediction period

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Please select one of the options below:

☐ Check if the claim will get approved ☒ Check if the PA will get approved

Select Drug Type

Select Payer

Select Patient Information Is the diagnosis correct?

☐ Yes ☒ No

Did the patient try and fail alternate medication?

☐ Yes ☒ No

Did the patient show contraindication to this medicine?

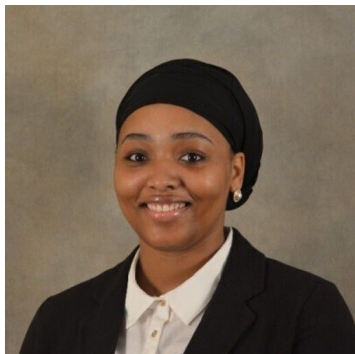
☐ Yes ☒ No

Prediction:

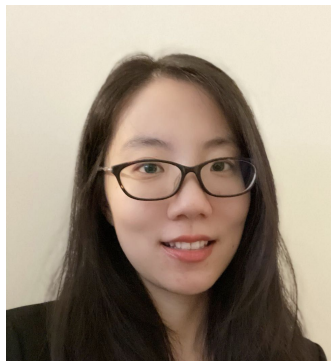
The probability of the PA approval is 97.75%

Thank You!

Questions?



Ruqiah Muhammad : EDA,
Build App



Siqi Sun: Time Series
prediction, Build App



Kavya Mukundan: EDA,
claim/PA approval Predictive
modeling, Build App