

ClassifyMyMeds

Predicting Prior Authorization Approval and Volume

Rachel Domagalski, Rachel Lee, Hannah Pieper, Rongqing Ye

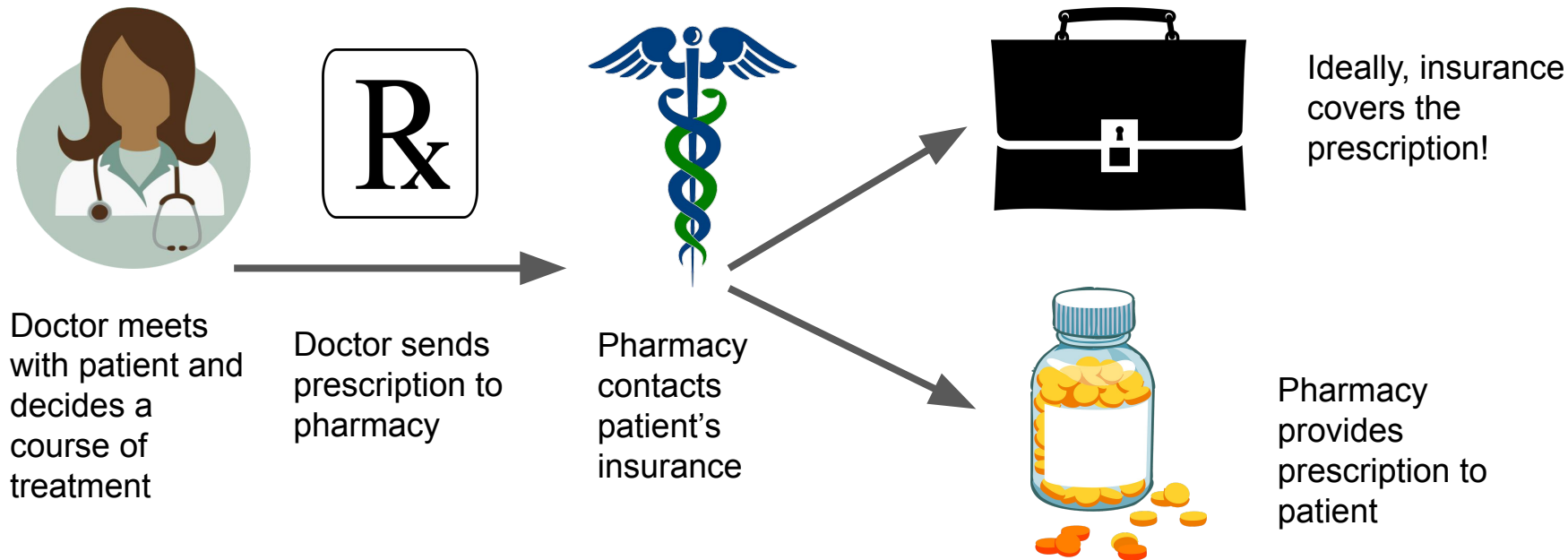
Team Ruby

<https://github.com/domagal9/classifymymeds>

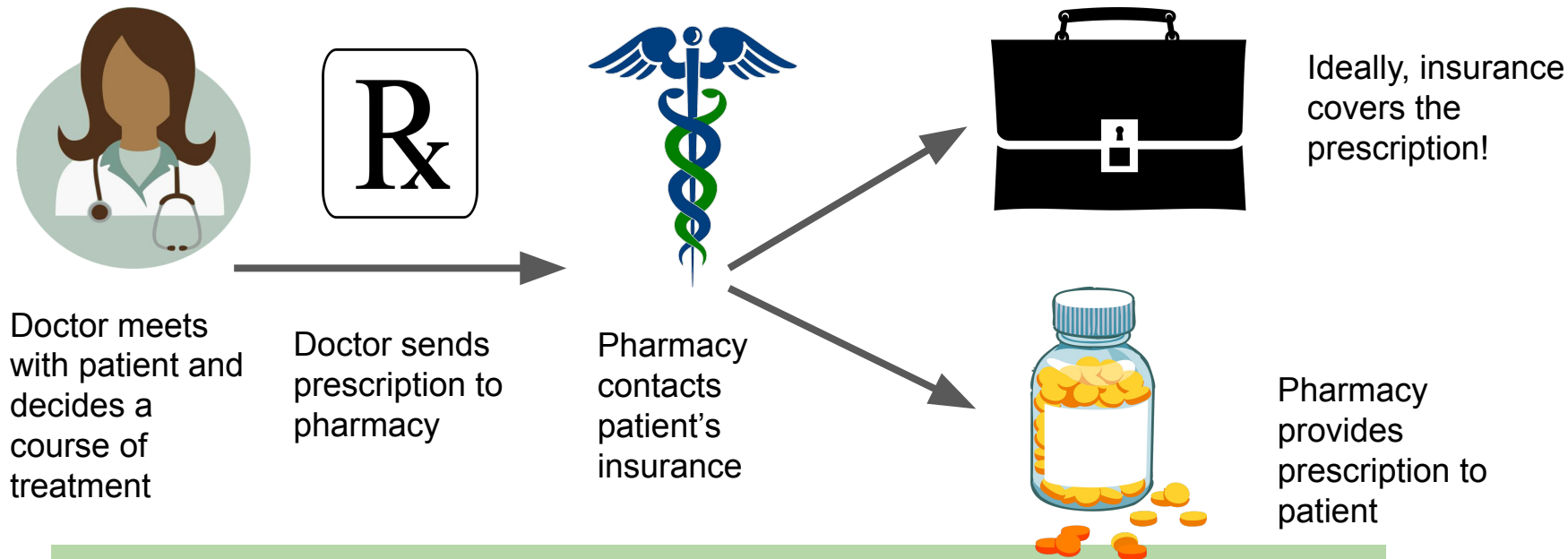


May 2021 Data Science Bootcamp

The Scenario: An American Healthcare Debacle



What Happens When Insurance Says No?



Then, a Prior Authorization is needed!

What Happens When Insurance Says No?

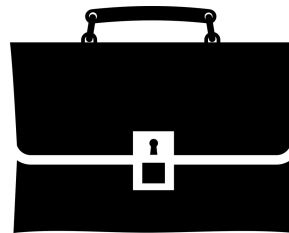


Doctor submits a PA that tells insurance about the patient & their health concerns



Includes information such as:

- Diagnosis
- Other Drugs Tried
- Contraindication



Insurance decides whether to now approve the prescription



If approved, the patient is provided their drug.

Then, a Prior Authorization is needed!

Team Ruby to the Rescue!

We can **predict** whether a prior authorization will be classified as approved or denied, saving patients and doctors time, and improving quick access to healthcare. [Ye + Pieper + Domagalski]

We can **forecast** future prior authorization volume at the monthly and daily level, predicting revenue and helping healthcare technology companies budget. [Pieper + Lee]



The Data: CoverMyMeds simulated a dataset of over 1 million fake pharmacy claims records, each indicating whether the pharmacy filled the prescription, whether a PA was needed, and if that PA was approved. Each entry also contains information about the insurance payer, drug, patient's medical details, and date.



Prior Authorization Classification

Classify whether a PA will be approved or denied based on drug, payer, and patient information.

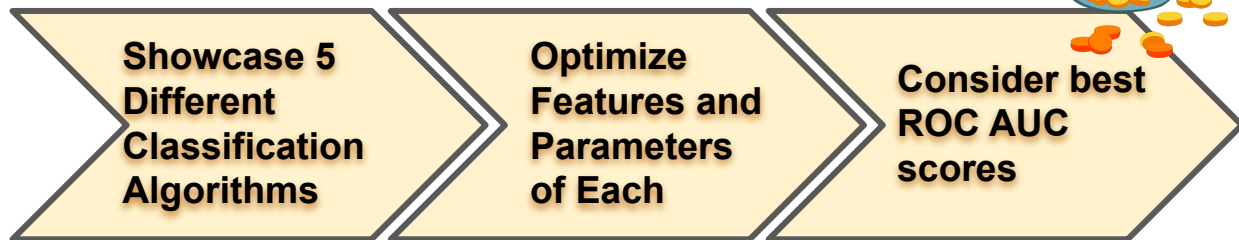


What Makes a Good Model?

True Positives improve speed to therapy and reduce prescription abandonment.

True Negatives let providers know sooner to change therapies, improving access to care.

ROC AUC considers both, an average of true positive rate and true negative rate.



Model	Accuracy	Precision	Recall	F1	ROC AUC
Fine-tuned Logistic	0.735462	0.930147	0.691770	0.793438	0.774038
Decision Tree	0.784086	0.877707	0.820280	0.848023	0.752150
Random Forest	0.784086	0.877707	0.820280	0.848023	0.752150
AdaBoost	0.770033	0.778863	0.959188	0.859671	0.603134
SVC	0.752271	0.767514	0.950615	0.849308	0.577263
Baseline	0.734374	0.734374	1.000000	0.846846	0.500000

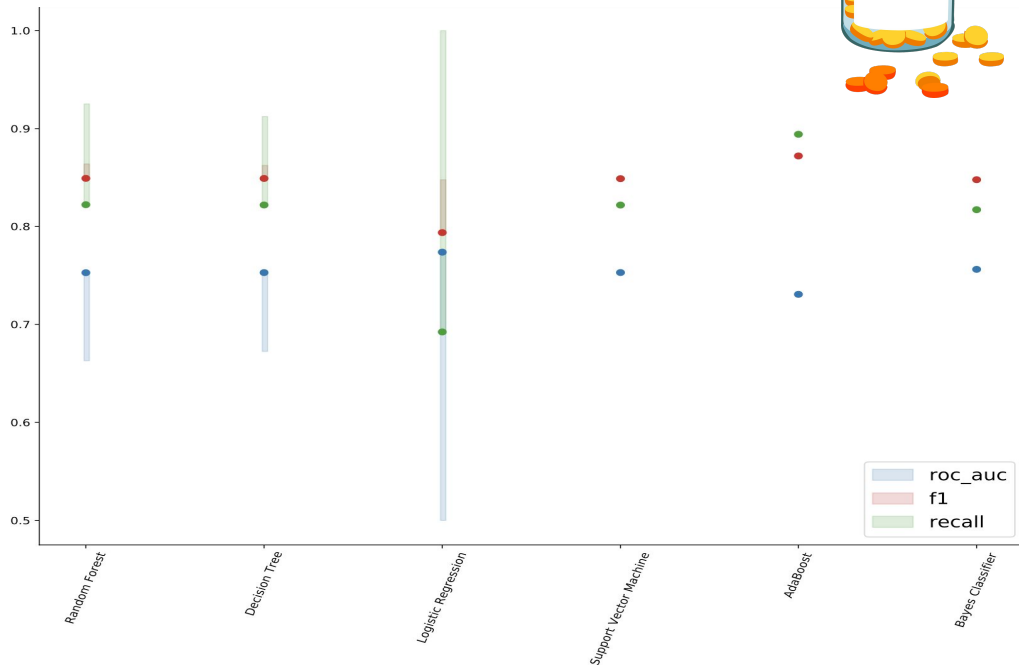
Prior Authorization Classification

Classify whether a PA will be approved or denied based on drug, payer, and patient information.



Are We Confident About These Estimates?

Model	Accuracy	Precision	Recall	F1	ROC AUC
Fine-tuned Logistic	0.735462	0.930147	0.691770	0.793438	0.774038
Decision Tree	0.784086	0.877707	0.820280	0.848023	0.752150
Random Forest	0.784086	0.877707	0.820280	0.848023	0.752150
AdaBoost	0.770033	0.778863	0.959188	0.859671	0.603134
SVC	0.752271	0.767514	0.950615	0.849308	0.577263
Baseline	0.734374	0.734374	1.000000	0.846846	0.500000



With highest ROC AUC, drop feature and permutation importance score, a Random Forest model should be used to predict prior authorization classification.

Prior Authorization Classification

Classify whether a PA will be approved or denied based on drug, payer, and patient information.



Check whether your PA will be approved on our app!

Prior Authorization Checker - Result

Payer 417380

Drug C

✗ correct diagnosis ✗ tried and failed ✓ contraindication

You need to file a prior authorization (code 70):
Drug C is not covered by the plan and is not on the formulary.

Your prior authorization has **2.76%** chance to be approved!

Prior Authorization Checker

Payer 417380

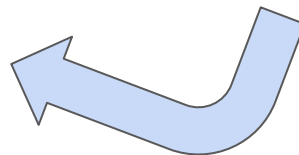
Drug C

☐ correct diagnosis

☐ tried and failed

☒ contraindication

Check!

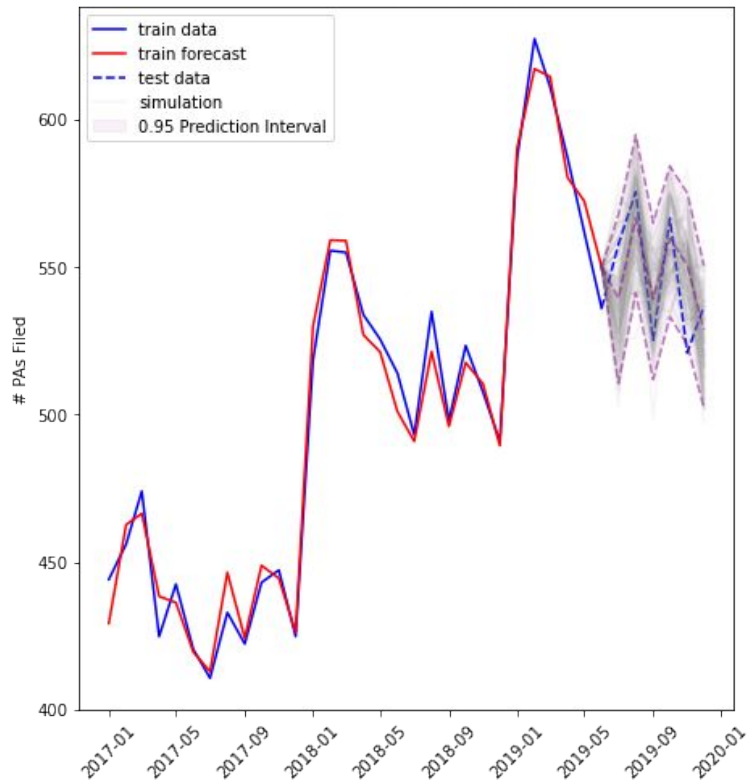


<https://pachecker.herokuapp.com/>



Prior Authorization Volume Forecast

Forecasting future PA volume at the monthly level



Methods Tested: Holt's Method, ARIMA, Simple Exponential Smoothing, Exponential Smoothing

**Additive Exponential Smoothing
Provides the Most Accurate Forecast**

Parameters: damped additive trend, additive seasonal period of length 12.

There is a 95.0% chance that our forecast will be within 5.26% of the true # of PAs filed monthly.



Prior Authorization Volume Prediction

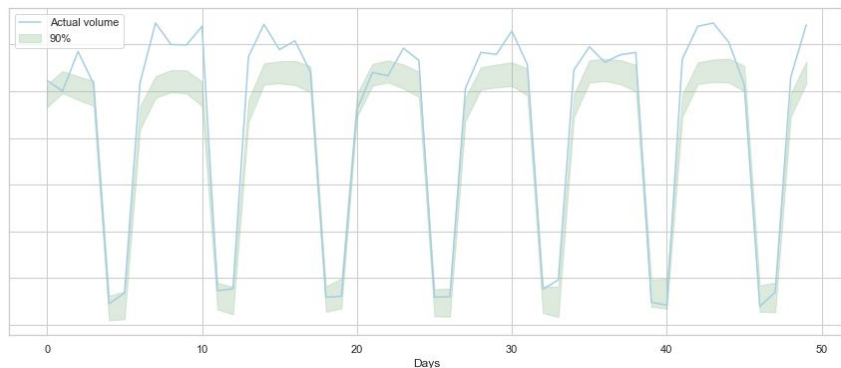
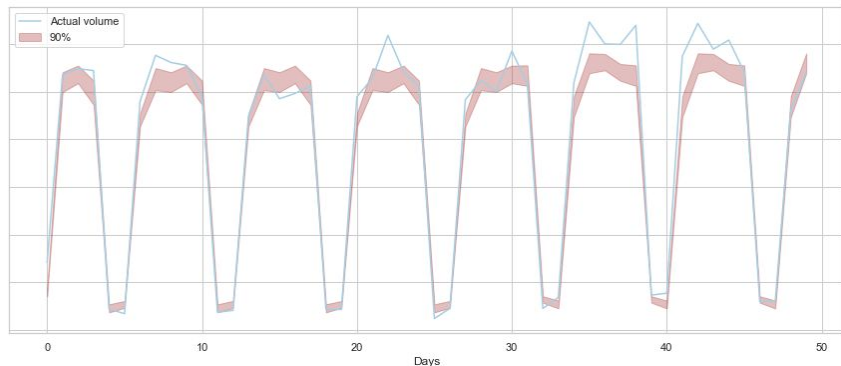
Forecasting future PA volume at the daily level



Method Tested:

Random Forest Regressor,
RNN (LSTM Model)

	Random Forest	LSTM
Accuracy	94.75	91.43
RMSE	36.71	39.88
Parameters	N/A	40 epochs 0.0 dropout rate
Misc	Requires a yearly volume for prediction.	Lower in accuracy.





Classification

**Prior Authorizations:
Approved or Denied**

Random
Forest
Model



Online App

This will help medical providers know *which* therapies are accessible to their patients, improve speed to treatment, and reduce prescription abandonment. Overall, this research will help improve access to care.



Forecasting

**Prior Authorization
Monthly & Daily
Volume**

Additive
Exponential
Smoothing



Random
Forest
Model



LSTM
Model

These forecasts are accurate enough to help medical technology companies like CoverMyMeds predict their monthly and daily volume, which will assist in budgeting and resource allocation.

ClassifyMyMeds



<https://github.com/domagal9/classifymymeds>

<https://pachecker.herokuapp.com/>

Team Ruby

Rachel Domagalski
domagal9@msu.edu
Michigan State
University

Rachel (Nakyung) Lee
rnklee@terpmail.umd.edu
University of Maryland,
College Park

Hannah Pieper
hpieper@bu.edu
Boston University

Rongqing Ye
thomasyrq@gmail.com
Purdue University



May 2021 Data Science Bootcamp