

How much will your prescription drugs cost?

Predicting copayments with machine learning



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How much will your prescription drugs cost?

(Well, it's complicated...)



Doctor diagnoses you and creates a treatment plan

Estimation of copayment

You go to a pharmacy for prescriptions



The cost is set by negotiations between the pharmacy, insurance, & drug manufacturer



✓ Insurance will cover part of the costs. You owe the remainder (copayment)



⊘ Insurance will not cover any costs (rejected claim). You owe the full price.

How does it help to have a prior estimation of copayment?



Know your estimated copayment while you are in the doctor's office

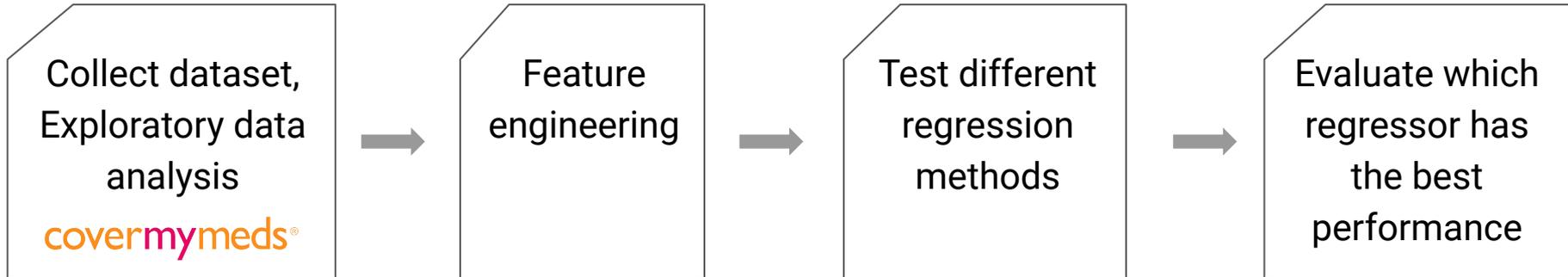
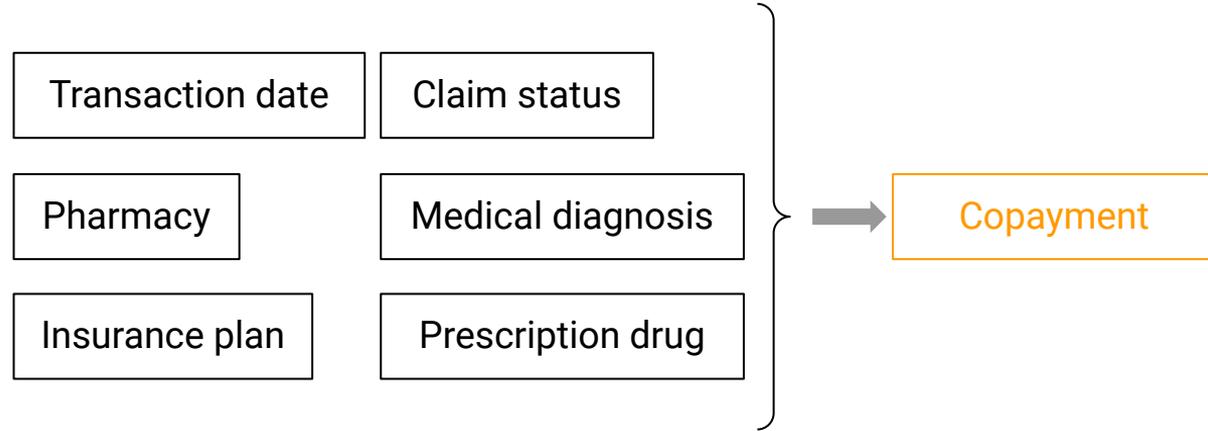
It will help patients work with doctors to find medications that are within the patient's budget.

Goal: Predict the required copayment ahead of time so that doctors are able to provide estimated costs to their patients

How do we use machine learning to predict copayments?

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Simulated dataset of transactions from different pharmacies that were taken across 1 year



Performance of difference regression methods

| Regression method | RMSE (\$) | RMSLE |
|--------------------------------|-------------|--------------|
| Simple average (baseline) | 40.5 | 0.895 |
| Average of Averages (baseline) | 31.9 | 0.706 |
| Linear regression | 18.5 | 0.554 |
| Decision tree | 15.9 | 0.346 |
| Random forest | 15.6 | 0.343 |
| Adaboost | 37.8 | 1.13 |
| Gradient boost | 19.6 | 0.519 |

Root mean squared error (RMSE)

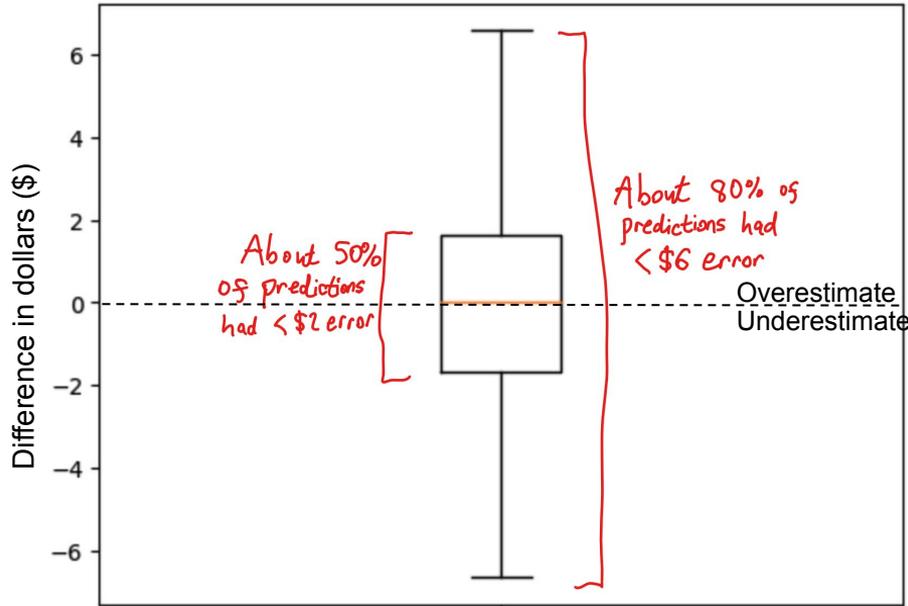
- Measures typical deviation (in \$) between our prediction and actual copay

Root mean squared log-error (RMSLE)

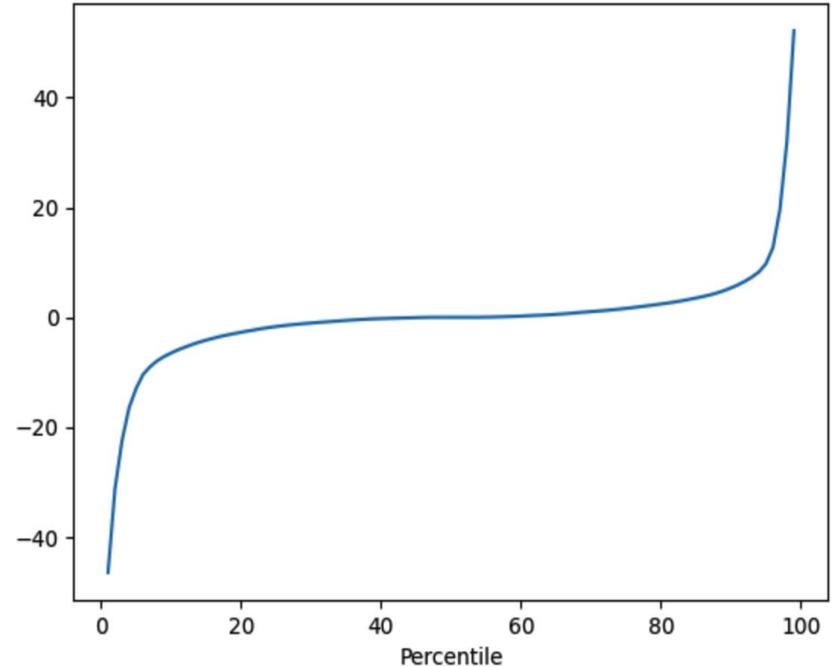
- Variant of RMSE that penalizes under-estimation more than over-estimation
- Copay surprises on the high end are more harmful to patients

How far off were our predictions?

Difference between predictions and actual copay



Random Forest Prediction Error by Percentile



Our predictions help provide a foundation for the future

Improvements

- Hypertuning different variables in the Random Forest model
- Train model with additional factors

Future directions

- Designing recommendation systems
- Creating interactive user interfaces



Github



[github.com/ksrivastava1/
pharmacy_data_analysis](https://github.com/ksrivastava1/pharmacy_data_analysis)

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