Machine Learning Model for Improving Auto Adjudication Rates For Large Provider – Sponsored Health Plan

Client Requirement

Client is a leading regional health plan and a subsidiary of one of the largest integrated health systems in the US. Using a legacy claims management system, the clients had a low Claims Auto Adjudication Rate (AAR) of 72%. It needed to increase AAR to align with industry benchmarks (over 90%).

CitiusTech was engaged to develop an AI/ML-based solution that would minimize the number of suspended claims, significantly improve the AAR. CitiusTech also needed to use the client's existing infrastructure for achieve this objective.
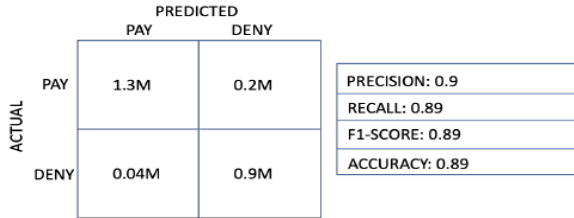
CitiusTech Approach

CitiusTech's team of AI/ML specialists and clinical data experts developed an AI/ML model that could accurately classify a claim line as Approved or Denied. 8 months of claims data was used to develop the model. It used a combination of categorical variables like diagnosis, procedure claim type etc. and continuous variables like billed amount, copy age of patient etc. CitiusTech also evaluated the business value of auto adjudication and the resultant cost savings due to more accurate classification of claims.
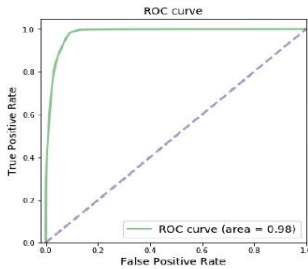
CitiusTech Solution

Data preparation (ETL) was done using pyspark connectors to a HIVE database on EDP's production edge-node, and subsequent modeling work was done using Python programming language on EDP's
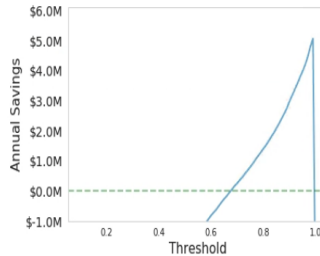
- EDA was performed using standard CitiusTech EDA framework to arrive at the final list of the input variables

- Feature engineering was done on input variables

  - Categorical variables with incidence <5000 were set to an 'other' category
  - NLP word2vec was leveraged to transform description variables (ICD 10 codes) into continuous vectors
  - All categorical variables were Label – Encoded

- Multiple models were evaluated and xgboost was the ML algorithm with highest performance and explain-ability

- Hyper-parameter tuning was done using Python's sklearn library on the test set to find the best parameters for the model

- The final model was run on the new data set to evaluate performance and accuracy

- Threshold of 95% was arrived considering the savings potential of identifying false positives and false negatives

CitiusTech

| | PREDICTED | |
| PAY | DENY |

ML Model Confusion Matrix of the Test Data with Accuracy Scores

Confusion matrix:

		PREDICTED	
		PAY	**DENY**
ACTUAL	**PAY**	1.3M	0.2M
	DENY	0.04M	0.9M

PRECISION: 0.9
RECALL: 0.89
F1-SCORE: 0.89
ACCURACY: 0.89

ROC Curve for the Predictive model showing a .98 Area Under Curve

Expected annual saving based on estimated costs of True Positive, Negative and False Positive, Negative predictions

ML Model Output

- CitiusTech delivered an xgboost ML model with high AUC score of .98 which indicated that the model is exceptionally good at predicting the outcome of a claim-line based on the provided inputs
- The model had an accuracy and F1 score of .89 and a precision and recall value of .9 and .89 respectively

Value Delivered

- Using historical data the costs of a False Positive and False Negative were estimated
- Using the same estimates CitiusTech was able to project an annual saving of ~ $5 Million on operationalizing the Machine Learning Model

About CitiusTech

CitiusTech is a specialist provider of healthcare technology services and solutions to healthcare technology companies, providers, payers and life sciences organizations. With over 4,000 professionals worldwide, CitiusTech enables healthcare organizations to drive clinical value chain excellence - across integration & interoperability, data management (EDW, Big Data), performance management (BI / analytics), predictive analytics & data science and digital engagement (mobile, IoT). CitiusTech helps customers accelerate innovation in healthcare through specialized solutions, platforms, proficiencies and accelerators. With cutting-edge technology, world-class service quality and a global resource base, CitiusTech consistently delivers best-in-class solutions and an unmatched cost advantage to healthcare organizations worldwide.

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