Prior Authorization Auto-Approval Model

Data Science Case Study

Joel Skaria

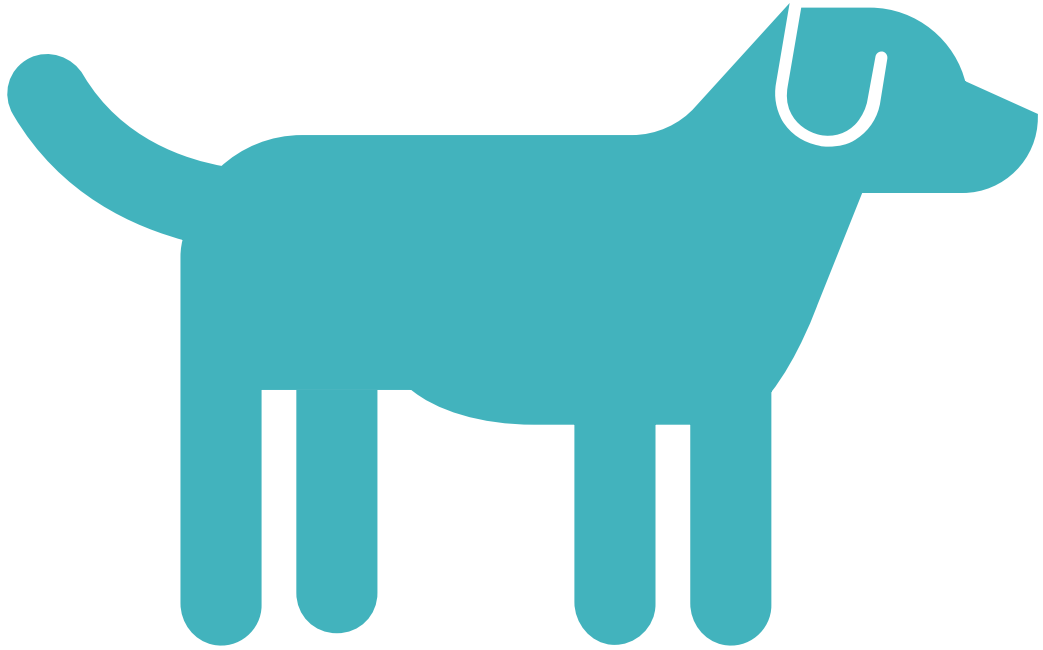
Executive Summary

+ **Project Overview**
- **Objective**: Develop ML model to automate prior authorization approvals
- **Scope**: Analysis of historical authorizations and claims data
- **Timeline**: 48-hour analysis and development

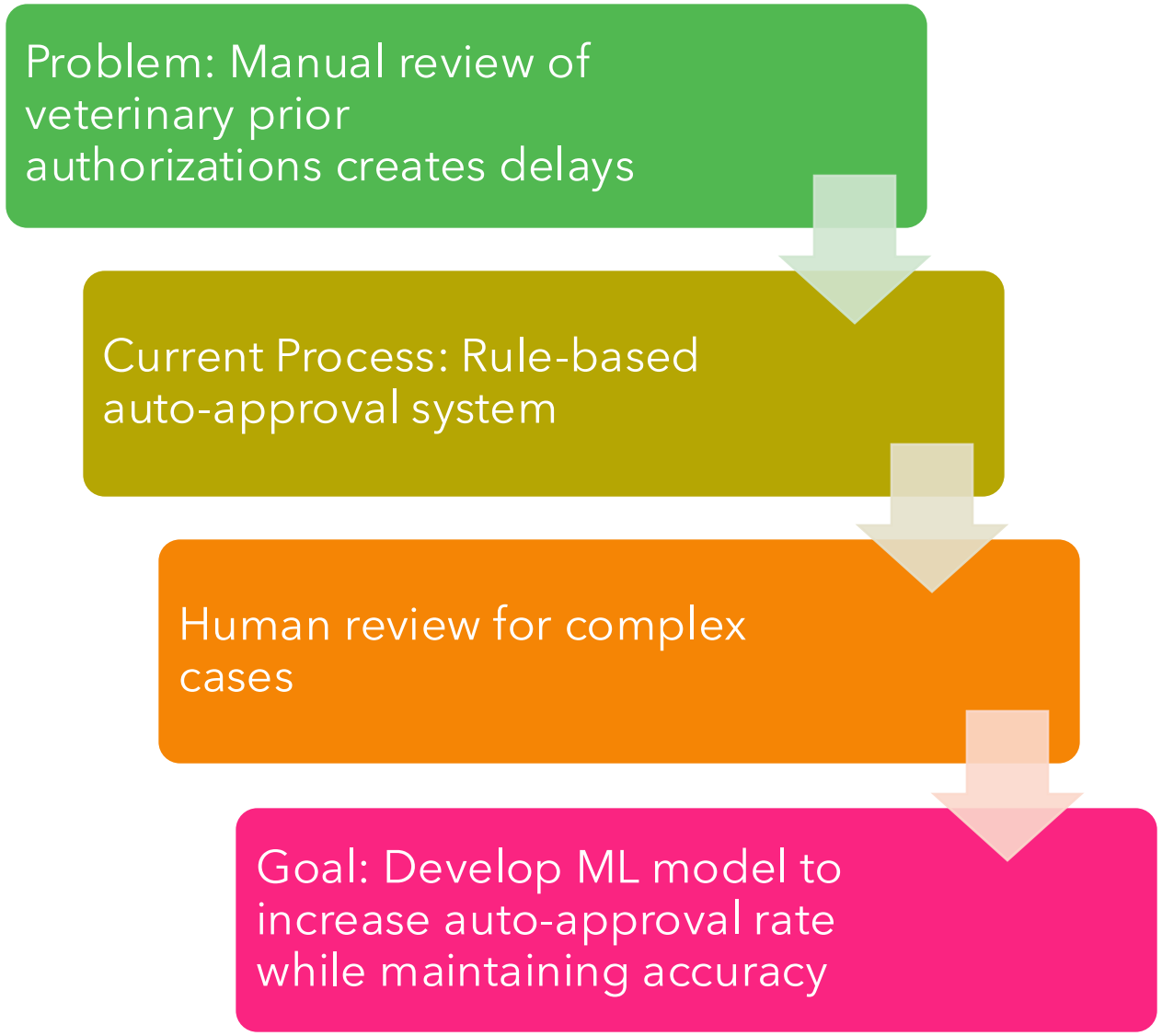
+ **Key Findings**
- Random Forest model achieved best performance
- Service type is strongest predictor of approval
- High model confidence across all metrics

Executive Summary Continued

+ **Performance Highlights**
- **94.6%** Accuracy
- **0.981** ROC AUC
- **0.911** F1 Score
+ **Expected Impact**
- ↓ Processing Time
- ↓ Operational Costs
- ↑ Veterinarian Satisfaction



Business Problem



Data Overview

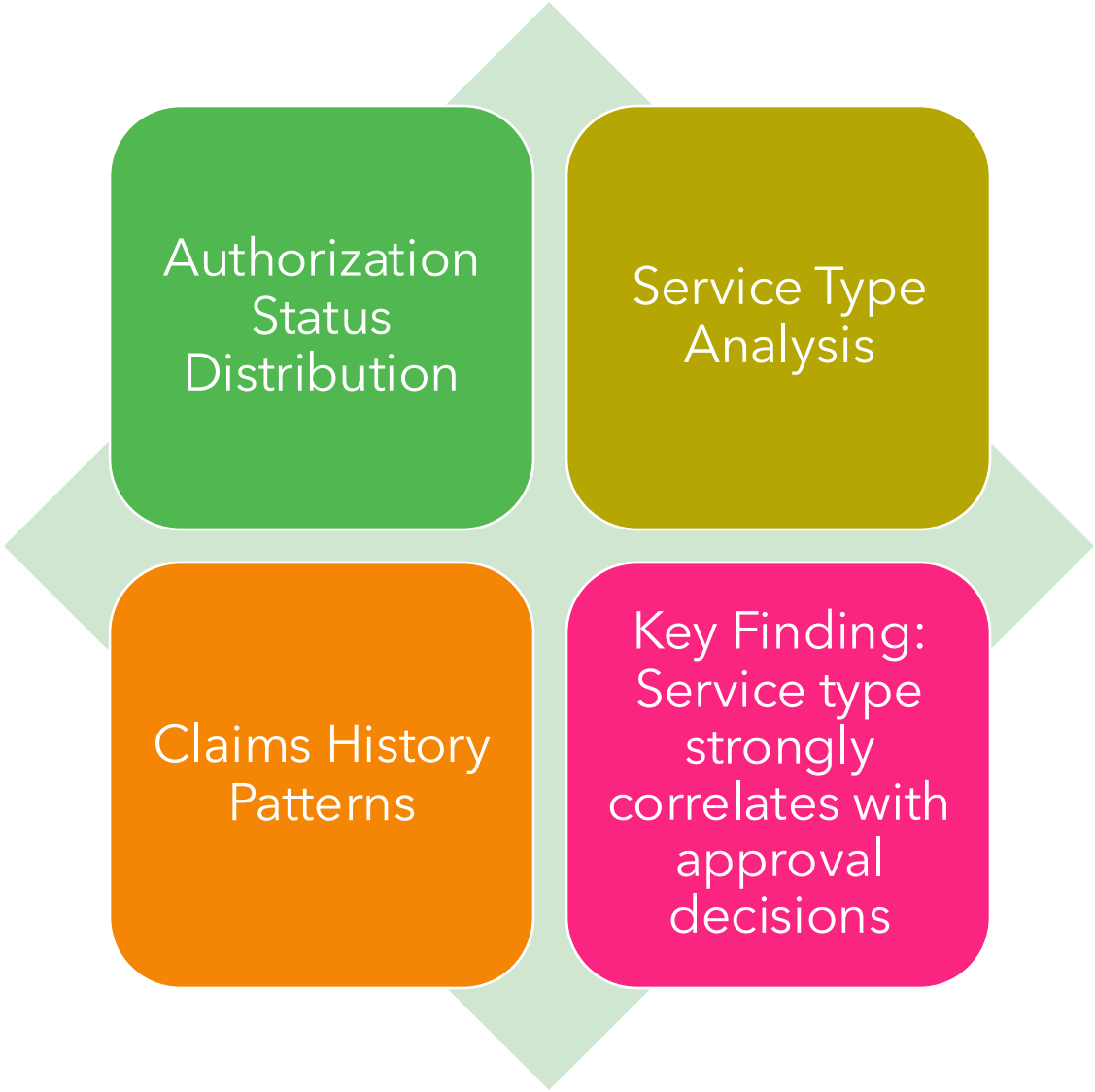
Two Primary Datasets:

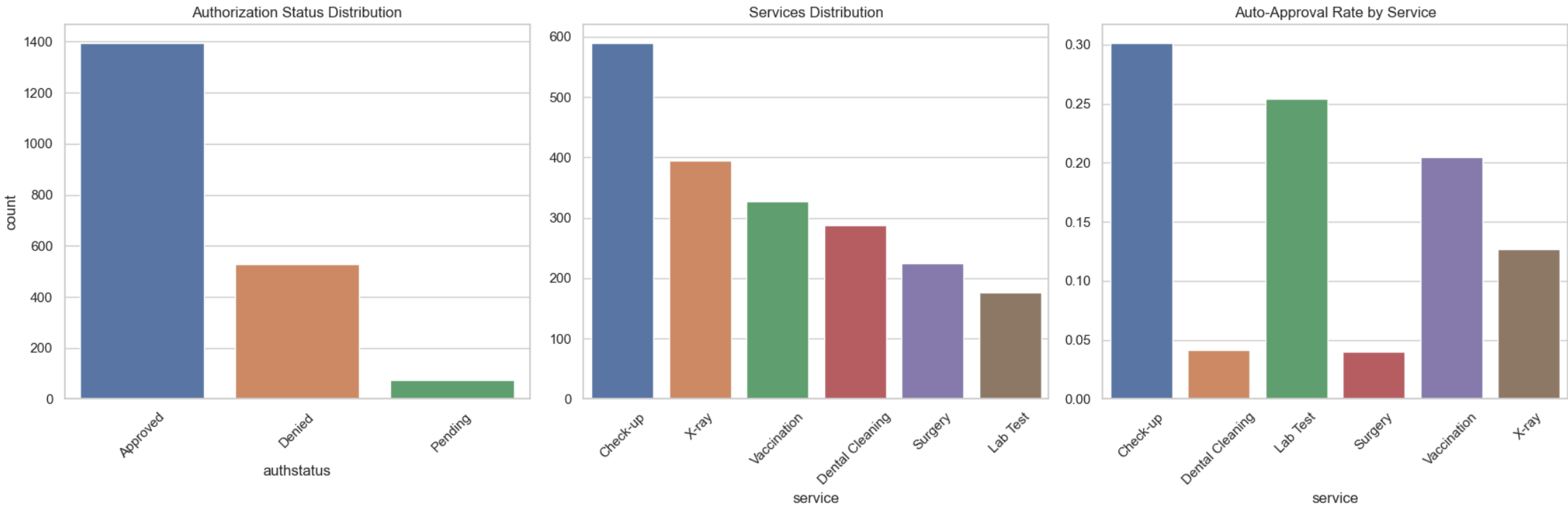
- Prior Authorization Data
- Claims History Data

Key Metrics:

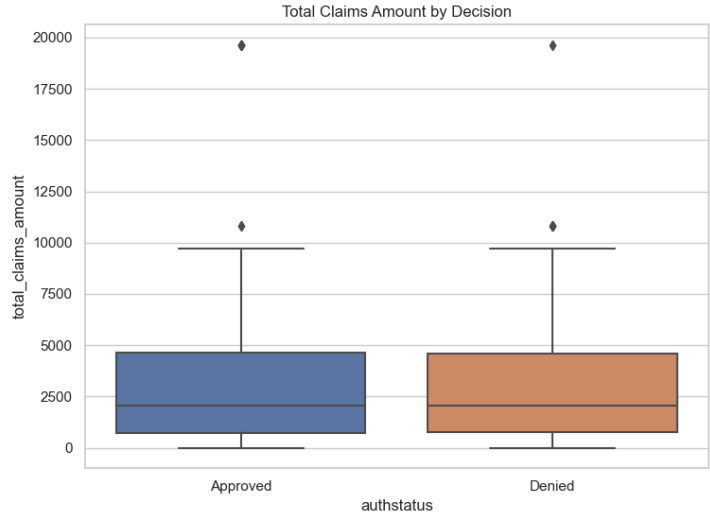
- Current auto-approval rate
- Average processing time
- Decision distribution

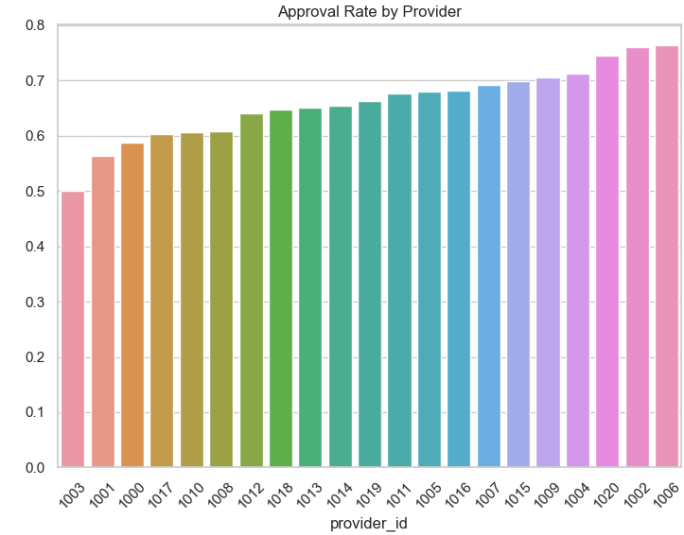
Exploratory Analysis

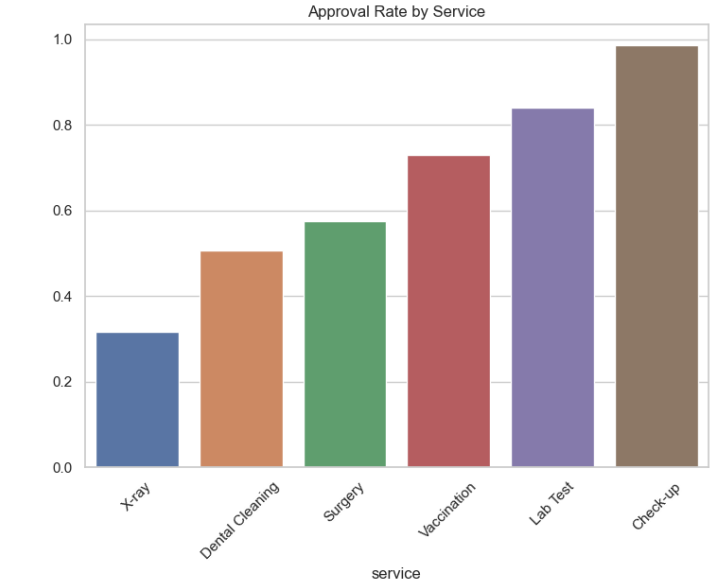



Authorization Status Distribution
count
1400
1200
1000
800
600
400
200
0
Approved
Denied
Pending
authstatus
Services Distribution
600
500
400
300
200
100
0
Check-up
X-ray
Vaccination
Dental Cleaning
Surgery
Lab Test
service
Auto-Approval Rate by Service
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Check-up
Dental Cleaning
Lab Test
Surgery
Vaccination
X-ray
service


Prior Claims Count by Decision
prior_claims_count
0
2
4
6
8
10
Approved
Denied
authstatus


Total Claims Amount by Decision
total_claims_amount
0
2500
5000
7500
10000
12500
15000
17500
20000
Approved
Denied
authstatus


Approval Rate by Provider
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1003
1001
1000
1017
1010
1008
1012
1018
1013
1014
1019
1011
1005
1016
1007
1015
1009
1004
1020
1002
1006
provider_id


Approval Rate by Service
0.0
0.2
0.4
0.6
0.8
1.0
X-ray
Dental Cleaning
Surgery
Vaccination
Lab Test
Check-up
service

Feature Engineering

- Created Features:
  - Prior claims count
  - Total claims amount
  - Service type encoding
  - Days since last claim
  - Provider history metrics

Models Compared

RANDOM FOREST

LOGISTIC REGRESSION

DECISION TREE

Model Development

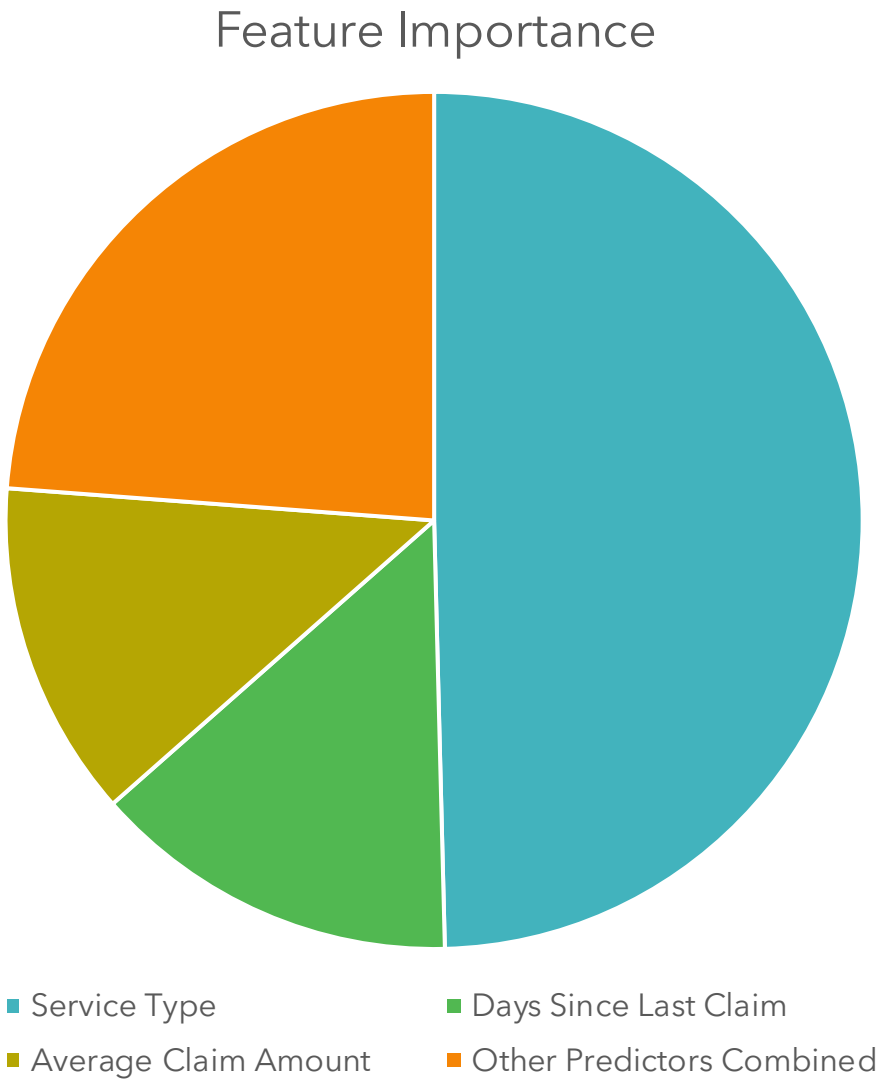
Approach:

- Tested multiple algorithms
- Cross-validation
- Hyperparameter tuning

Best Model: Random Forest

- 94.6% Accuracy
- 0.981 ROC AUC
- 0.911 F1 Score

Feature Importance



Model Performance

- Metrics:
  - •Accuracy: 94.6%
  - •ROC AUC: 0.981
  - •F1 Score: 0.911
  - •Average Precision: 0.961

Implementation Plan

Phased Rollout:

Start with highest-confidence services

Gradual expansion to other categories

Monitoring System:

Real-time performance tracking

Regular model retraining

Business Impact

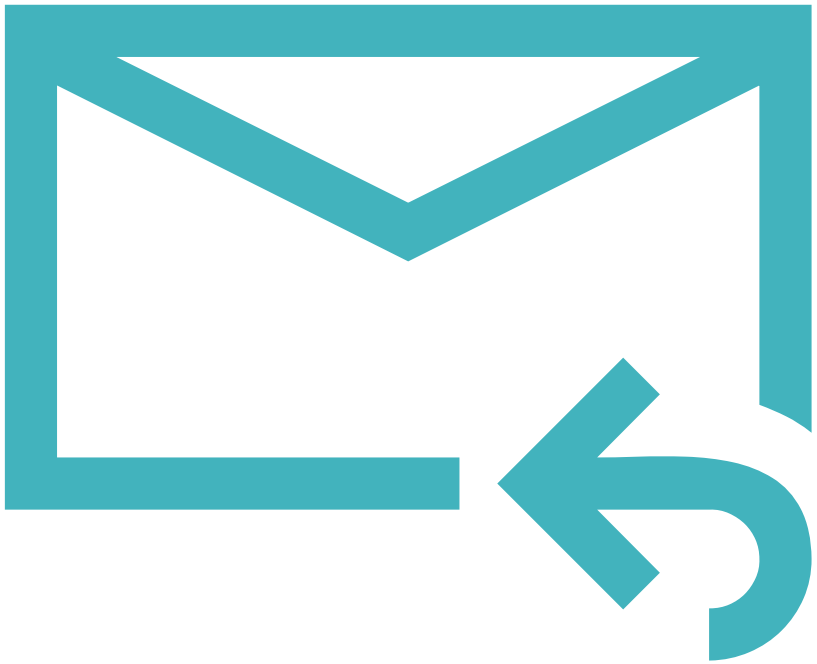
+ Expected Benefits:
  - •Reduced processing time
  - •Lower operational costs
  - •Improved veterinarian satisfaction
  - •Maintained decision quality

Next Steps

+ Recommendations:

1. Begin phased implementation
2. Set up monitoring dashboard
3. Plan regular model updates
4. Collect feedback from stakeholders

Questions?



+ Contact: Joel Skaria, joel.skaria.js@gmail.com