

# IntelliStay

## An AI-Powered Framework for Auto Insurance.

### Churn Prediction and Prevention

Team Red Devils  
Megathon'25

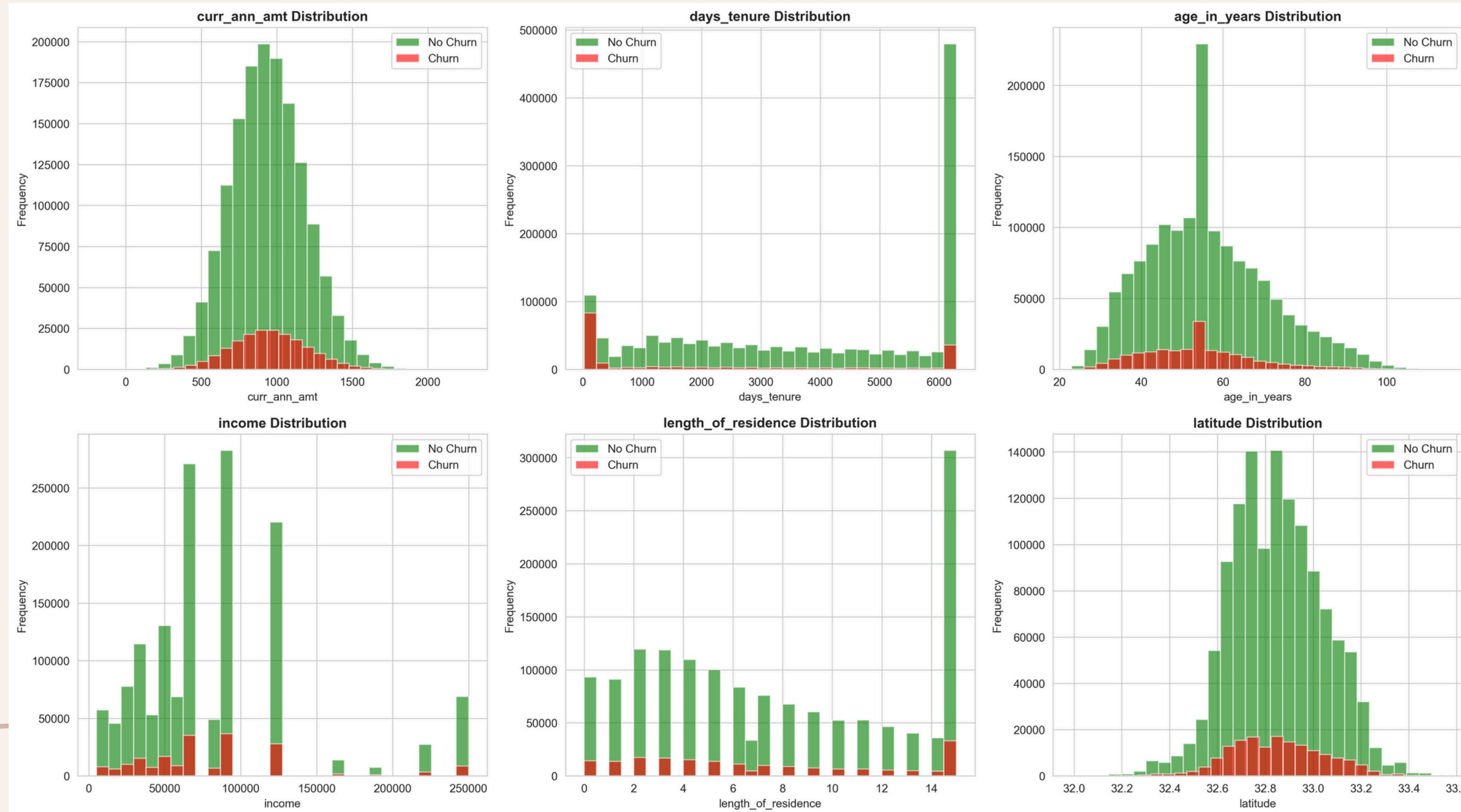
# The High Cost of Churn

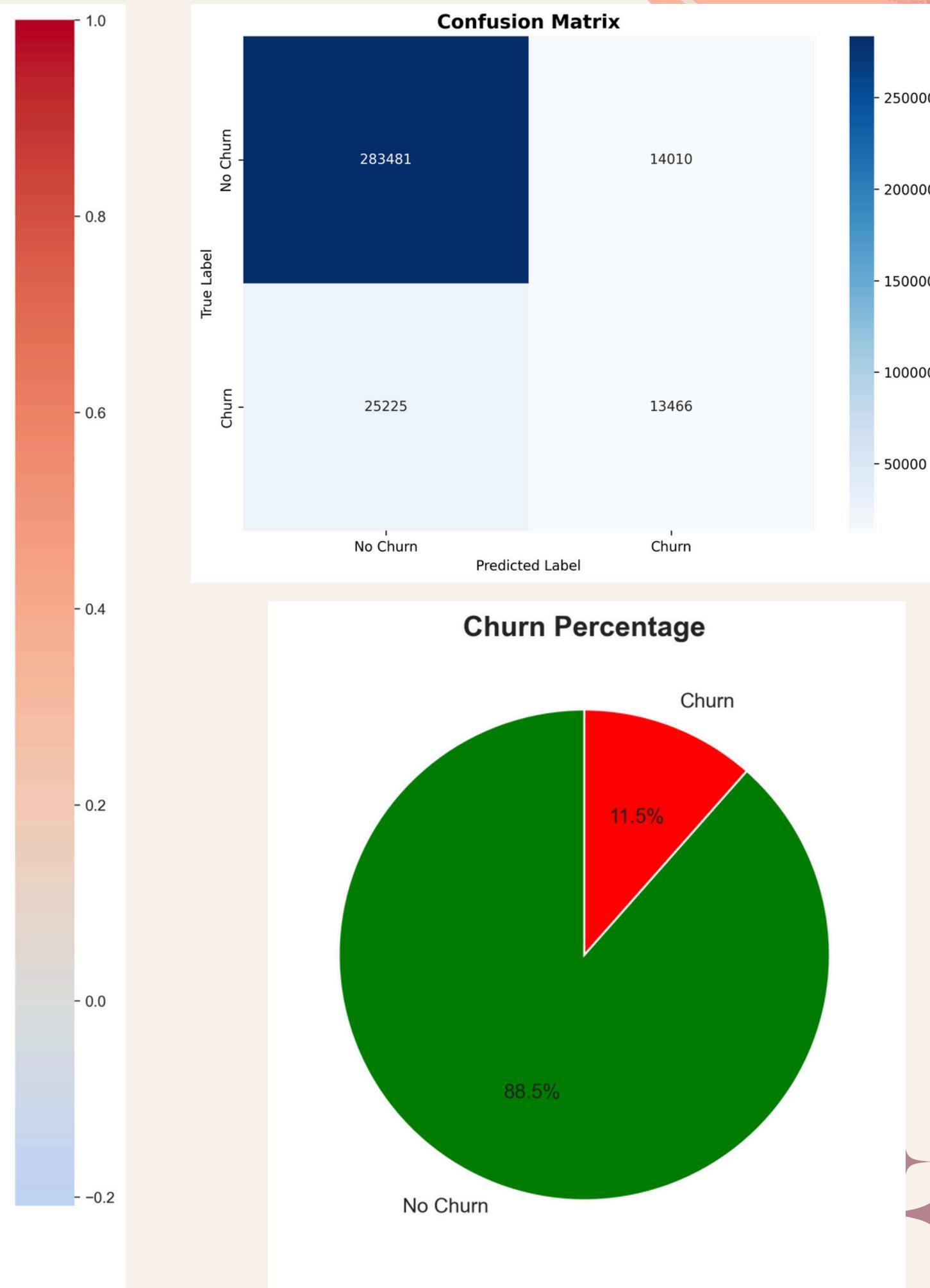
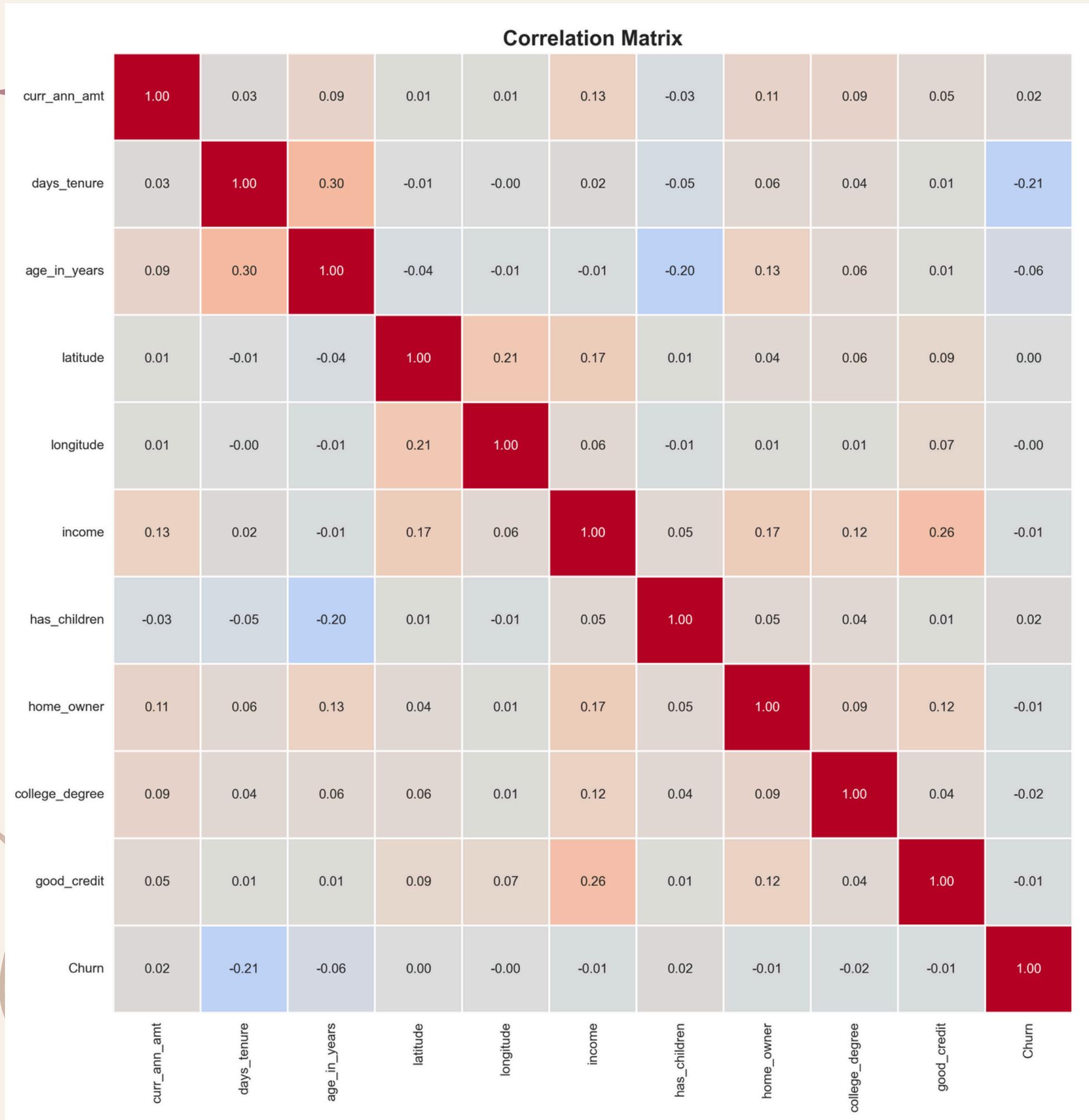
- The cost of acquiring a new customer is five-times higher than retaining an existing customer
- Challenges for companies to predict the reasons for customers to leave
  - Comparable services available from competition at much more competitive rates
  - Lack of a unified machine learning prediction model to provide triggers for frequent customer churn
  - Accidental churn, at times, may occur due to sudden change in customer financial situation
  - Lack of Customer retention strategies and incentive plans to minimize churn

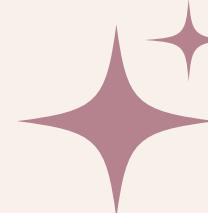
# From Reactive to Proactive

- The gaps in traditional methods
  - The “Black Box” Problem
  - Lack of Personalization
- Our solution “IntelliStay” solves these problems by employing advanced AI to generate personalized recommendations
- It protects client privacy by providing agents with actionable insights without directly displaying sensitive client data

# Data Analysis and Preprocessing

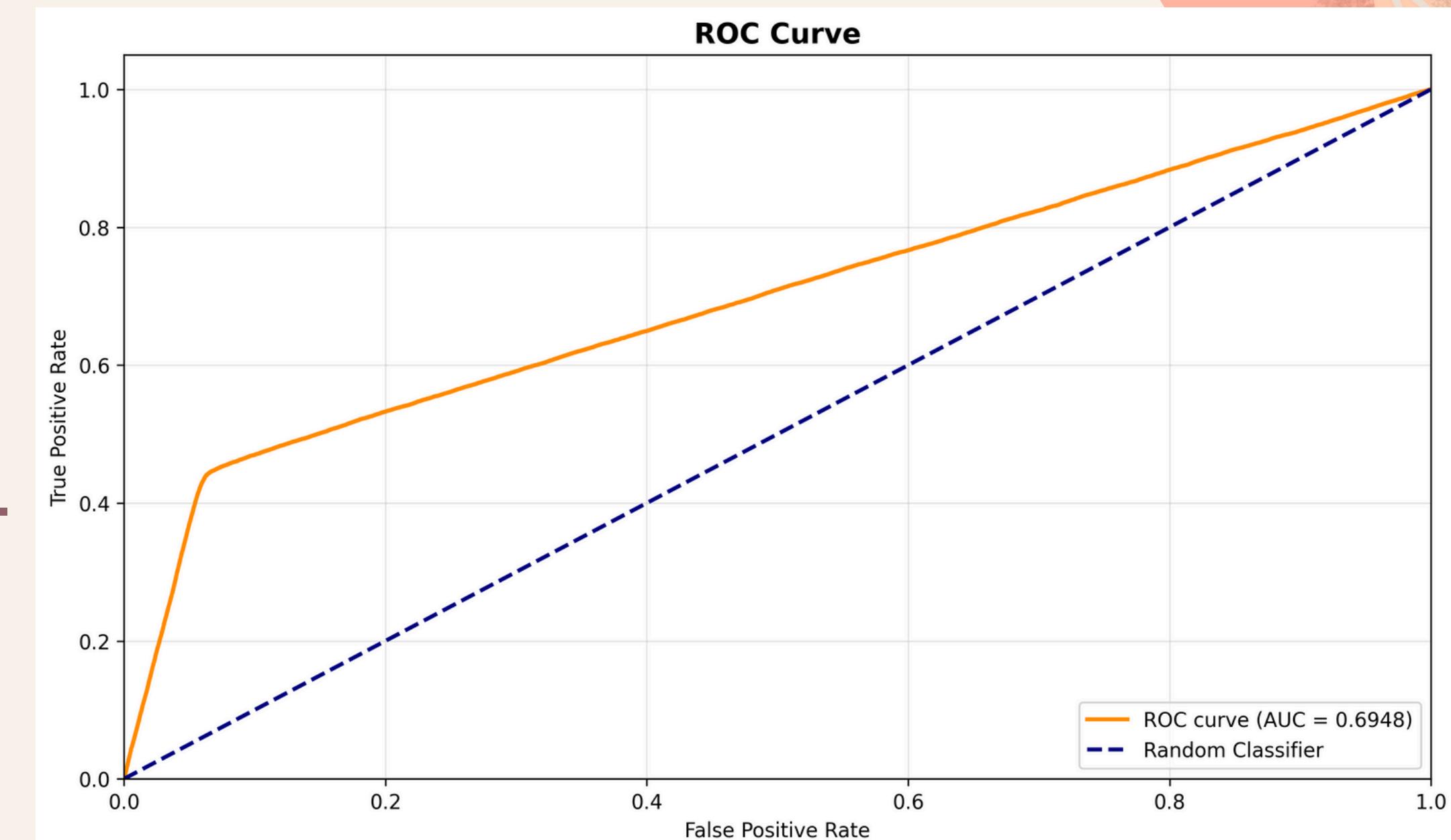
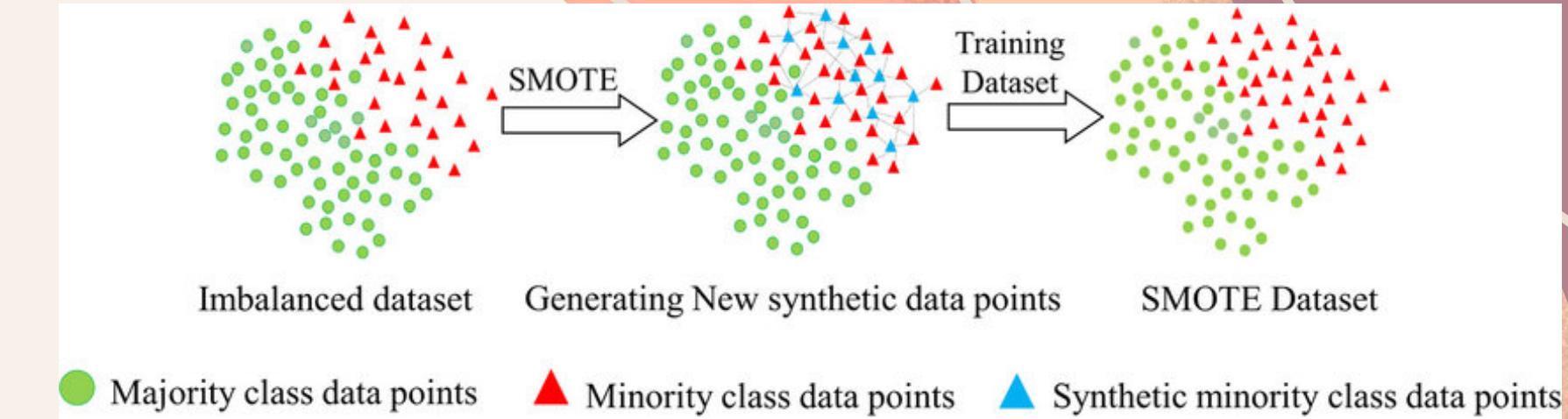






# Churn Risk score

- Handling class imbalance with SMOTE
- We chose XGBoost (Extreme Gradient Boosting), a SOTA algorithm, for its exceptional performance on structured data. It provides the optimal balance of accuracy, speed, and interpretability required.





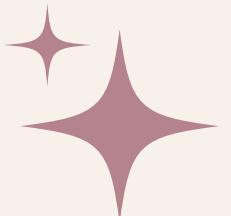
# Explainable AI and DiCE

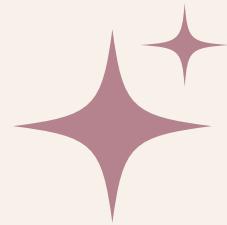
- **Why Explainable ?**

Explainability is crucial when understanding why a solution works (or fails) is as important as the solution itself. This is essential in high-stakes scenarios where knowing the model's behavior and error sources allows for debugging, building trust, and preventing major problems.

- **Relevance to Current Scenario**

For churn prediction, this means knowing the root causes (e.g., high premium) behind the forecast to implement effective customer retention strategies.



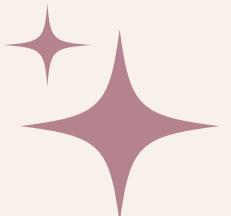


- **SHAP**

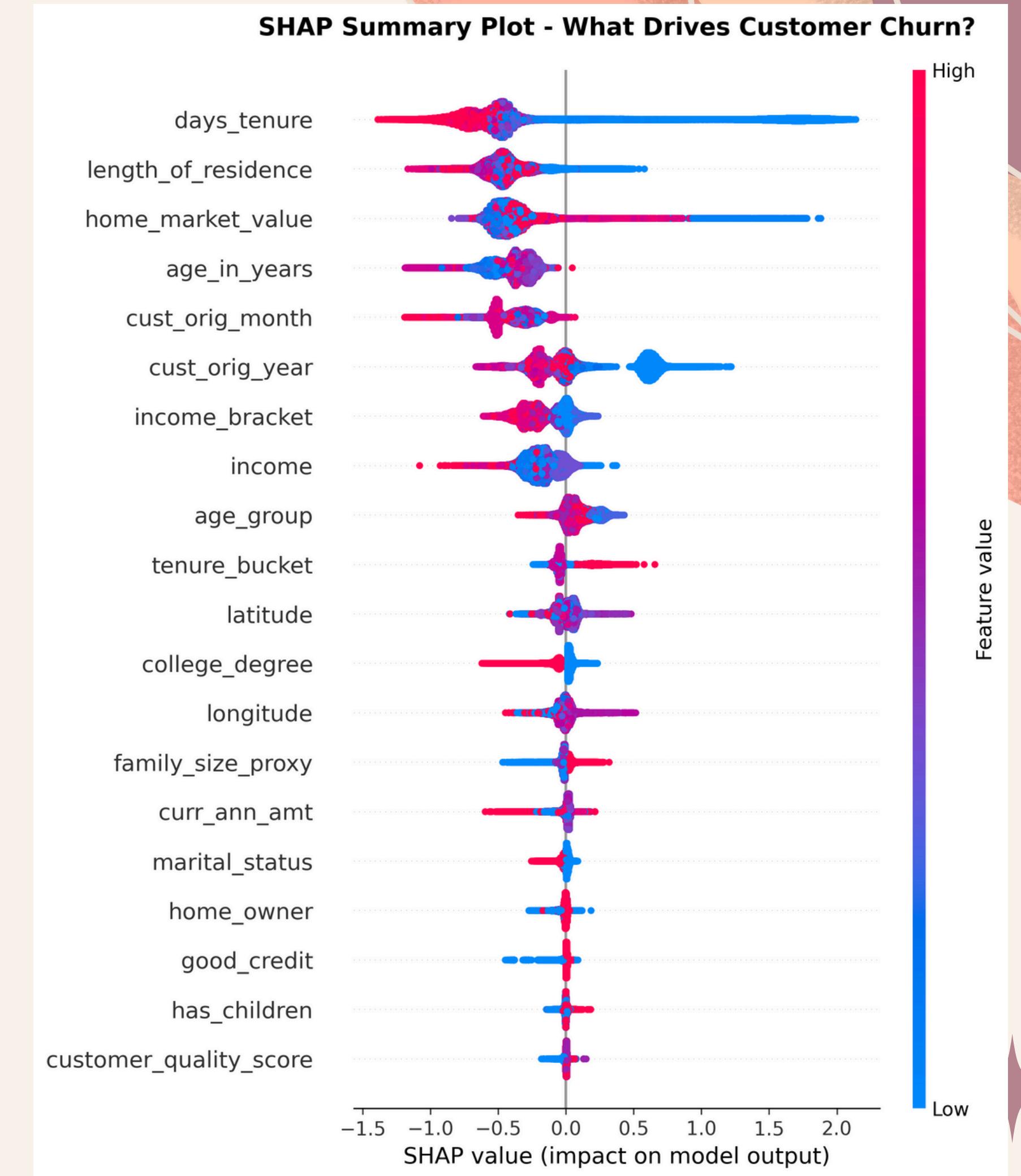
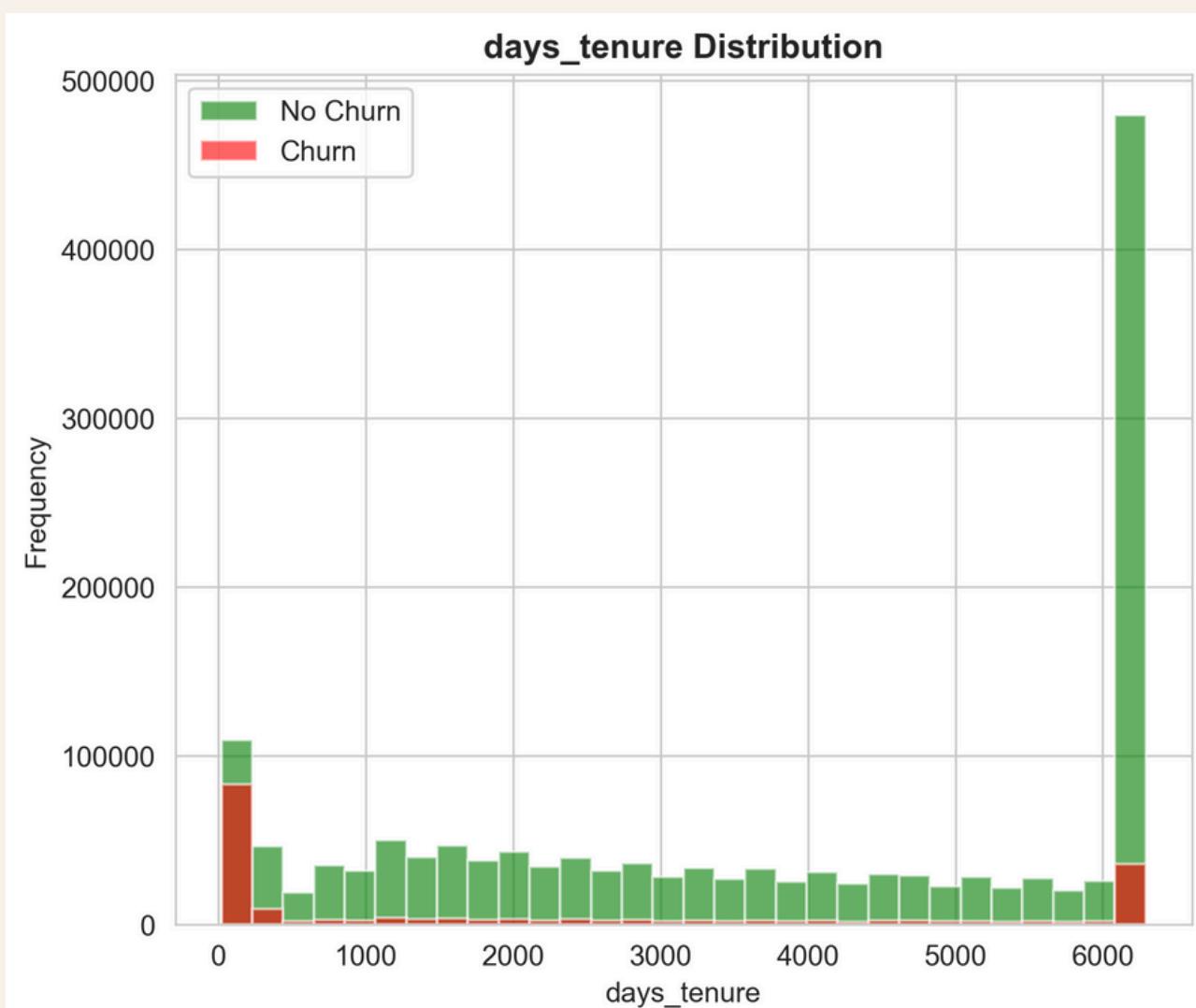
SHapley Additive exPlanations is a powerful technique rooted in Shapley values from cooperative game theory which explains individual predictions by **calculating the contribution of each feature to the final outcome**. A key advantage of SHAP is its ability to provide both local and global explanations. Unlike LIME, SHAP's results are theoretically grounded and stable.

- **DiCE**

Diverse Counterfactual Explanations is an algorithm that provides multiple ‘what-if’ scenarios that would flip the model’s prediction. This gives structured input to the LLM which translates into a compelling retention strategy.



- As seen from the days\_tenure plot, churn is highly probable got low tenure customers, thus the strategy is to retain for at least an year to reap long term benefits.
- Similar analysis can be done about other features.



# ★ AI-Gen Retention Strategies

- Our AI system uses a carefully engineered prompt to the open-weight LLM hosted locally. We inject three key inputs:
  - (1) Customer Context - the churn probability and top 3 SHAP-identified risk factors
  - (2) Global Intelligence - portfolio-wide churn patterns and industry benchmarks
  - (3) Counterfactual Guidance - DiCE-generated scenarios showing changes that reduce churn.
- The prompt explicitly instructs the LLM to provide four outputs: a one-sentence customer persona, a brief explanation of why they might leave, three actionable retention steps, and, most importantly, a behavioral nudge strategy.

```
Generating counterfactuals for 3 high-risk customers
=====
Customer 14 | Original Churn Risk: 75.2%
=====
100%|███████████| 6.59s/it]

RETENTION STRATEGY OPTIONS:
  Found 3 counterfactual scenarios

OPTION 1:
  New Churn Risk: 8.6% (was 75.2%)
  Risk Reduction: 66.6%

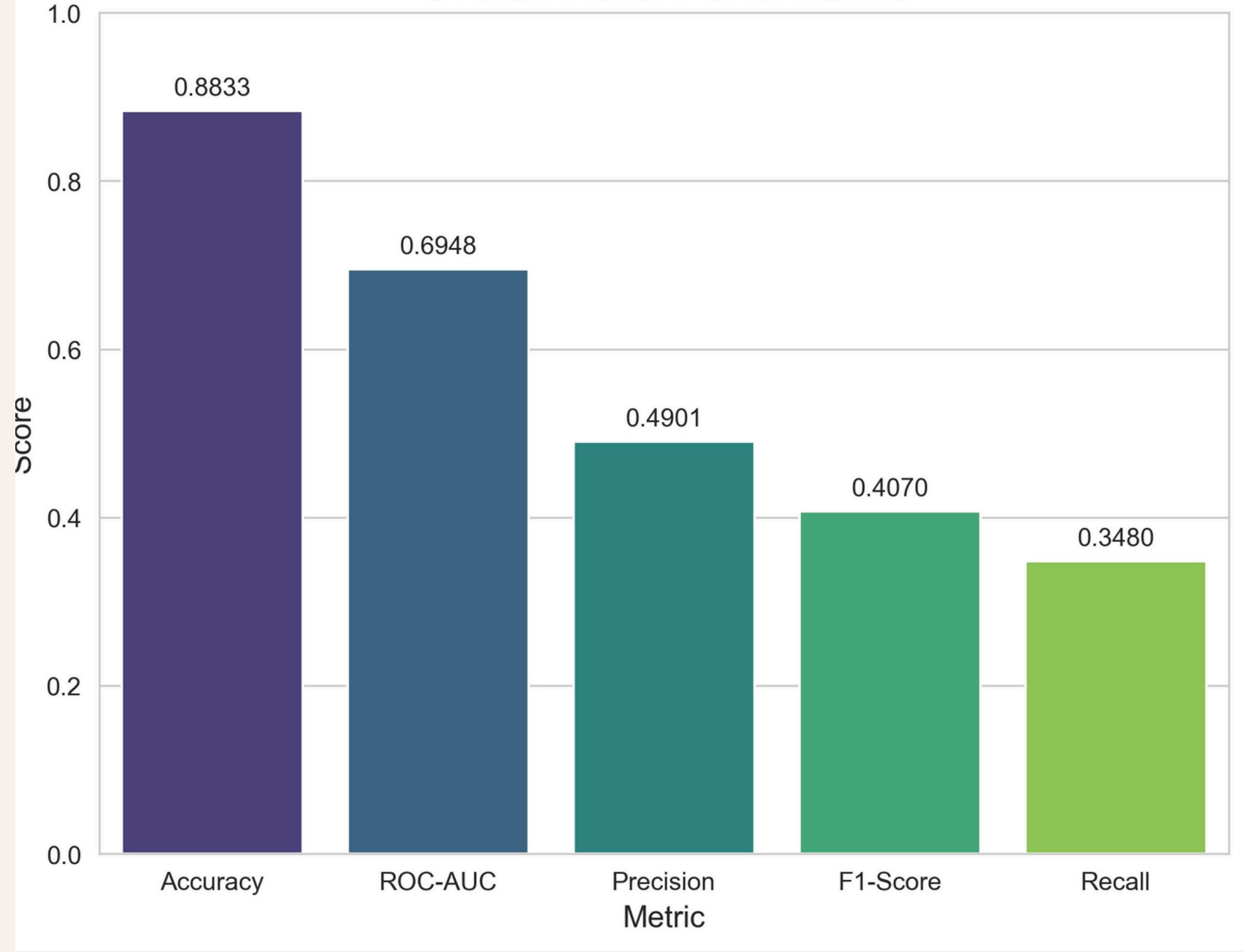
  💰 curr_ann_amt:
    Original: $741.67
    New:      $370.84
    Change:   -50.0%
  💳 premium_affordability:
    Original: $0.59
    New:      $0.57
    Change:   -4.3%
  💵 premium_to_income_ratio:
    Original: $0.01
    New:      $0.01
    Change:   -4.3%
```



# Behavioral Nudges: Psychology Meets AI

- Rather than relying solely on generic discounts, we integrate six evidence-based psychological principles into our recommendations. The system intelligently selects the most appropriate nudge based on the primary churn driver:
  - Loss Aversion reminds customers what they'll lose by leaving (e.g., "You'll forfeit your \$847 accident-free bonus")
  - Social Proof leverages peer behavior (e.g., "92% of customers in your area renewed this plan")
  - Reciprocity offers unexpected value (e.g., "Complimentary vehicle health check-up")
  - Commitment Devices lock in benefits (e.g., "Secure your rate for 2 years")
  - Scarcity creates urgency (e.g., "This offer expires in 48 hours")
  - Anchoring frames savings positively (e.g., "You've saved \$2,340 with us over 3 years")
- Each nudge comes with a ready-to-send message template that agents can use immediately, combining data science with behavioral economics for maximum retention impact.

## Overall Model Performance



# Novelty

- Using a locally hosted open-weight LLM to generate effective retention strategies based on DiCE, SHAP outputs, behavioural sciences, and Neuroeconomics.
- A privacy-centred approach where the users' sensitive information is not directly accessible to the agents; instead, a proxy persona is generated.
- On-premise (qwen3-4B) delivers real-time strategy generation with zero cloud or API dependency, ensuring data privacy, cost efficiency.
- Interactive "What-If" Simulator: Real-time churn probability recalculation and analysis as agents adjust parameters by using a slider.



# Live Demo

- [Click Here](#)

# Business User Dashboard

Select View:

- Churn Dashboard
- Customer Deep Dive
- Retention Simulator

## IntelliStay Churn Analysis Dashboard

**Portfolio Overview**

Average Churn Risk <b>14.7%</b> <small>↑ 3.2% vs baseline</small>	High Risk Customers <b>1,472</b> <small>↑ +1472</small>	Revenue at Risk <b>\$1,398,400</b> <small>↑ Annual</small>	AI Strategist <b>Online</b> <small>↑ LM Studio</small>
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**Top Churn Drivers (Global Analysis)**

**Feature Importance**

**Top Churn Drivers - Feature Importance Rankings**

Feature	Importance
days_tenure	Very High
length_of_residence	High
home_market_value	Medium-High
age_in_years	Medium
cust_orig_month	Medium-Low
cust_orig_year	Low
income_bracket	Very Low
income	Low
age_group	Very Low
tenure_bucket	Very Low

**Impact Direction**

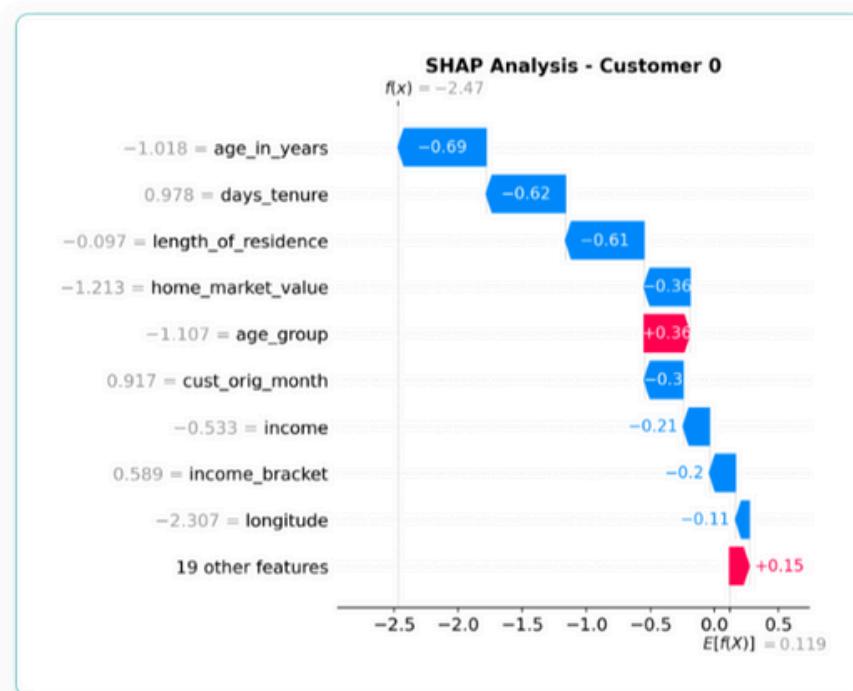
**SHAP Summary Plot - What Drives Customer Churn?**

The SHAP summary plot displays the impact direction for ten features: days\_tenure, length\_of\_residence, home\_market\_value, age\_in\_years, cust\_orig\_month, cust\_orig\_year, income\_bracket, income, age\_group, and tenure\_bucket. The plot shows that all features have a positive impact on churn, with 'days\_tenure' having the highest impact.

# Customer Deep Dive

## Risk Factor Analysis (SHAP)

Why is this customer at risk?



## Top Risk Factors

- age\_in\_years: -1.02 (Impact: -0.688)

## AI-Powered Strategic Recommendations

Powered by Local LLM

This is an insurance retention question. I'm an expert in behavioral economics and insurance customer psychology.

**CUSTOMER PERSONA:** A long-tenured, young, low-risk driver who has maintained a strong safety record.

**WHY THEY MIGHT LEAVE:** This customer is highly sensitive to their perceived 'price of staying'—they are a low-risk driver who likely values cost efficiency over other factors. Their churn is strongly driven by their age, meaning they are likely a young driver (e.g., 20–29 years old) who is price-sensitive and may be actively comparing insurers for a better rate.

### RETENTION ACTIONS:

- Immediate action 1 (Financial):** Proactively email a personalized 'rate lock' offer showing their current premium will remain fixed for the next 12 months based on their accident-free history.
- Immediate action 2 (Service):** Offer a free 15-minute 'driver safety audit' session to reinforce their low-risk profile and build

## Top Risk Factors

- age\_in\_years: -1.02 (Impact: -0.688)
- days\_tenure: 0.98 (Impact: -0.619)
- length\_of\_residence: -0.10 (Impact: -0.612)
- home\_market\_value: -1.21 (Impact: -0.360)
- age\_group: -1.11 (Impact: +0.359)

for the next 12 months based on their accident-free history.

- Immediate action 2 (Service):** Offer a free 15-minute 'driver safety audit' session to reinforce their low-risk profile and build relationship trust.
- Immediate action 3 (Value-add):** Send a personalized 'accident-free bonus tracker' showing their progress toward an annual \$250 discount.

### BEHAVIORAL NUDBE STRATEGY:

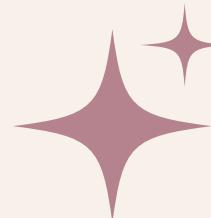
**Loss Aversion** is the most effective approach here. Young drivers often weigh immediate savings against long-term benefits. By emphasizing the *concrete loss* of losing their accident-free discount, you create urgency to stay without feeling like you're being 'sold to'.

### NUDGE RECOMMENDATION:

"Your streak of 3 years accident-free is worth \$250 off your next bill! If you leave now, that discount vanishes forever. Stay with us, and your savings stay locked in."

### MESSAGE TEMPLATE:

"Your streak of 3 years accident-free is worth \$250 off your next bill! If you leave now, that discount vanishes forever. Stay with us, and your savings stay locked in."



# Retention Simulator

Deploy



## Premium Adjustment Parameters

💡 Use sliders to simulate discount scenarios

Annual Premium (\$)

389.00

## Simulation Results

Original Risk

9.1%

New Risk

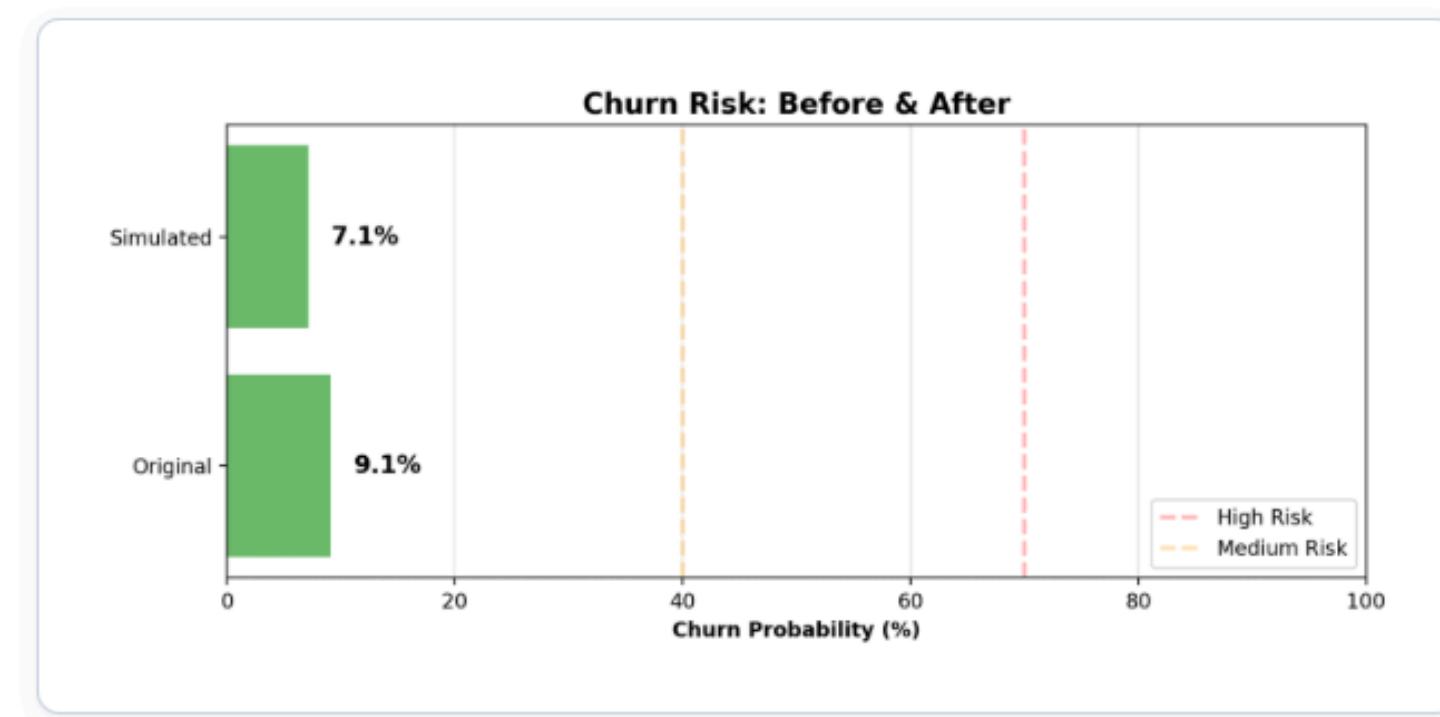
7.1%

Risk Reduction

2.0%

↓ -2.0%

## Risk Comparison



## Calculated Metrics:

Premium/Income Ratio

0.0092

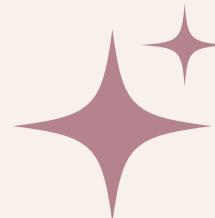
↓ -0.0049

Affordability %

0.92%

↓ -0.49%

SIMULATE IMPACT



# Retention Simulator

## 💡 Recommended Action Plan:

### Premium Adjustment:

- Original annual premium: **\$598.12**
- New annual premium: **\$389.00**
- Discount offered: **\$209.12 (35.0%)**

### Expected Impact:

- Churn risk reduction: **2.0%**
- New monthly payment: **\$32.42**

### Next Steps:

1. 📞 Contact customer within 24-48 hours
2. 💬 Present personalized retention offer
3. 📄 Document interaction in CRM
4. 📅 Schedule follow-up in 30 days

## 💰 Business Impact:

Annual Revenue

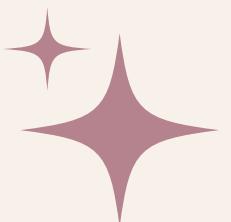
**\$598.12**

Retention Cost

**\$209.12**

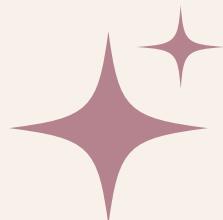
Expected Value

**\$555.38**



# Building Responsible AI

- **Ensuring Transparency:** We leverage Qwen3-4B LLM to translate complex, local model reasoning (like that from XGBoost) into comprehensible explanations for crucial outcomes like customer churn.
- **Actionable Insight Generation:** This process moves beyond a mere prediction, providing "why" and "what-if" insights that are essential for responsible decision-making and business intervention.
- **Local Model Accountability:** By generating faithful explanations for individual predictions, we bridge the gap between high-performance black-box models and the need for auditability and user trust.



# Pros

**Explainability & Transparency**

**High Predictive Accuracy**

**Behavioral Science Integration**

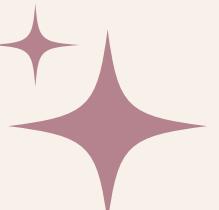
**Real-Time Interactive Simulation**

# Cons

**Model requires periodic retraining,  
doesn't adapt in real-time**

**Limited Historical Context**

**Single Product Focus**

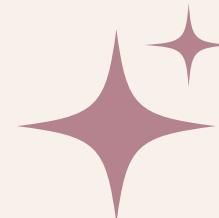


# The Road Ahead: Improvements

- Expand beyond Auto insurance: home, life, health, ...
- Voice-based interface for field agents
- Chatbot with Advanced Natural Language Processing
- Auto-generate email templates, WhatsApp messages from LLM insights for seamless execution of strategies

# Summary: A Paradigm Shift

- From prediction to explanation to prescription – all in one platform. Our system doesn't just tell you WHO will churn. It tells you WHY they'll leave, WHAT to change, and HOW to communicate it. Built for Megathon 2025. AI that actually retains customers.
- Every year, insurance companies lose 15 to 25 percent of their customers to churn – costing billions in revenue. The problem? Traditional systems can predict WHO will leave, but they can't explain WHY, or tell you WHAT to do about it....UNTIL NOW!



# References and Acknowledgement

- **Dataset**

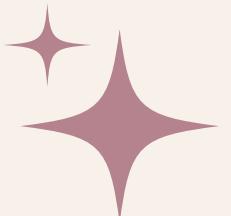
Kaggle Dataset

- **Research Approach**

Churn Prediction using XAI

Customer Churn prediction methods

Customer\_Churn\_Prediction\_for\_a\_Motor\_Insurance\_Company





# Thank You