Profit-Aware Time-to-Churn & Retention Decision System

Business Problem

Customer churn reduces recurring revenue, but **retention budgets are limited**.
Most churn models identify *who* may churn, but fail to answer:

- **When will the customer churn?**
- **Is it financially worth saving them?**
- **Which customers should be prioritized for retention?**

This leads to inefficient spending on low-value or unprofitable customers.

Approach

I reframed churn prediction as a **time-to-event problem** and built a decision system that combines:

1. **Survival Analysis** to estimate *when* each customer is likely to churn
2. **Forward-looking Customer Lifetime Value (CLV)** based on predicted remaining lifetime
3. **Profit-aware retention logic** that accounts for intervention cost and uncertainty

Instead of minimizing churn, the system **maximizes expected retention profit**.

Methodology

- Modeled time-to-churn using **Cox Proportional Hazards**
- Generated **individual survival curves** and churn probabilities over 3–6 month horizons
- Estimated **expected remaining lifetime** for each customer
- Computed **forward CLV = Monthly Revenue × Expected Lifetime**
- Designed a **retention decision engine** using expected value:

$$\text{Expected Value} = (\text{CLV} \times P(\text{Retention Success})) - \text{Retention Cost}$$

Only customers with positive expected value were targeted.

Key Insights

- Churn risk is **highest in early customer lifecycle**, especially for month-to-month contracts

- High churn risk does **not** imply high business value
- ~20% of customers account for a **disproportionate share of future CLV**
- Risk-based targeting wastes retention budget on low-value customers

Business Impact

- Profit-aware targeting **outperformed risk-only targeting**
- Reduced retention volume while **increasing expected ROI**
- Enabled clear, defensible retention decisions:
    - *Who to target*
    - *When to intervene*
    - *Who to let churn*

Final Recommendation

Retention efforts should be **CLV-weighted and time-sensitive**, not probability-based alone.
The proposed system enables scalable, financially sound churn mitigation.