

# Customer Churn Prediction System

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## Executive Summary

This project's objective was to proactively reduce customer churn by developing a machine learning system capable of identifying at-risk customers. Through an in-depth analysis of historical data, we identified several key drivers of churn, with **Month-to-Month contracts, low customer tenure, and high monthly charges** being the most significant predictors.

The final deliverable is a comprehensive, interactive dashboard built with Streamlit. This tool provides two core functions: a live prediction engine for scoring individual customers and an analytics dashboard that visualizes the strategic insights gathered. The system is powered by a fine-tuned Logistic Regression model, selected for its superior ability to find churners, achieving a final **Recall of 79%**.

## The Churn Prediction Tool

The centerpiece of this project is a live application that allows business managers to get a real-time churn probability for any customer. By inputting a customer's account and service details, the tool leverages the trained machine learning model to provide an instant prediction and a recommended course of action.

# Live Customer Churn Prediction

Enter a customer's details below to get a real-time churn prediction.

## Account Info

Tenure (months)

01272

Contract

Month-to-month

Payment Method

Electronic check

Paperless Billing

☒ Yes

☐ No

## Charges

Monthly Charges (\$)

70.00

Total Charges (\$)

1394.55

## Customer Info

Gender

☒ Male

☐ Female

Senior Citizen

☒ No

☐ Yes

Has a Partner?

☒ Yes

☐ No

Has Dependents?

☒ Yes

☐ No

## Subscribed Services

Phone Service

Yes

Multiple Lines

No phone service

Internet Service

DSL

Online Security

No

Online Backup

Yes

Device Protection

No

Tech Support

No

Streaming TV

No

Streaming Movies

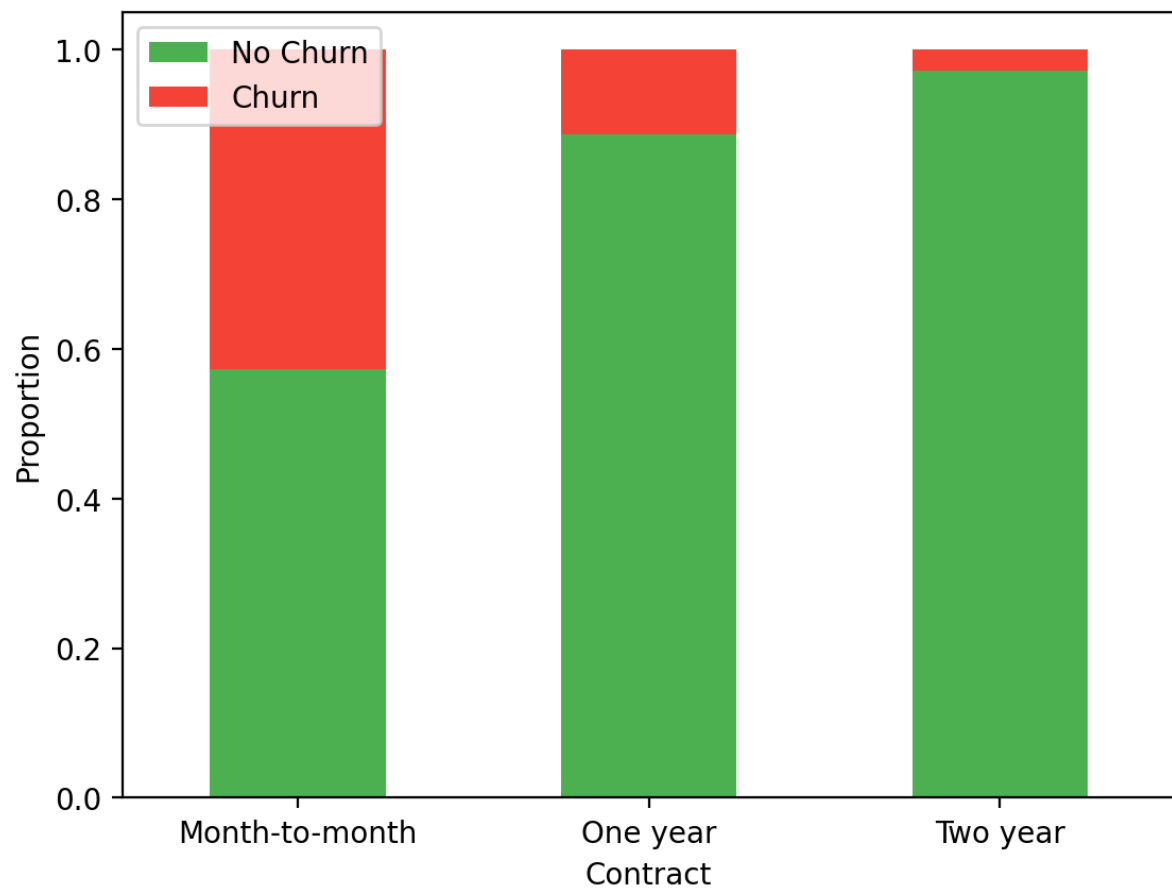
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**Figure 1:** The live prediction tool interface.

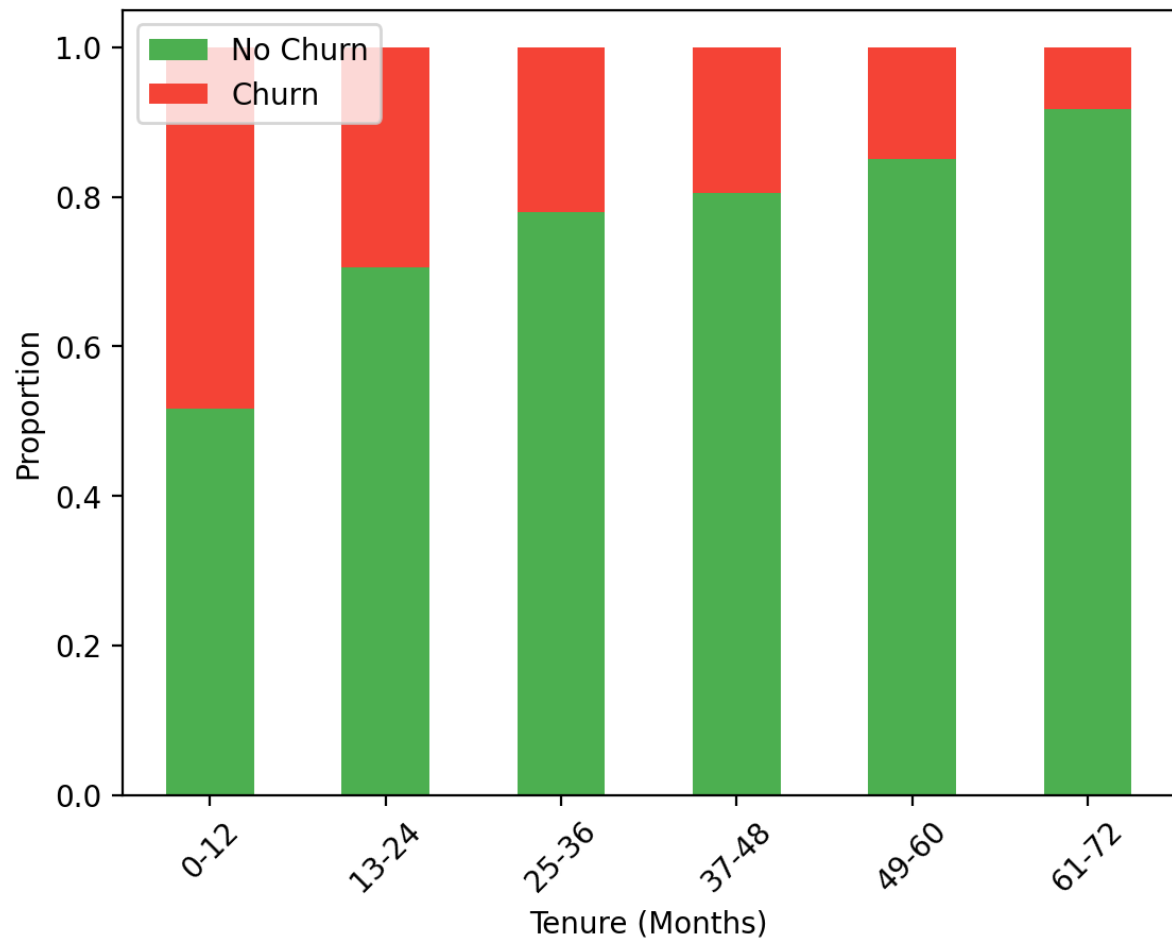
## Key Churn Drivers: Analytics Dashboard

A key component of the system is an analytics dashboard designed to provide a strategic overview of why customers churn. The following charts visualize the most significant patterns discovered in the data.

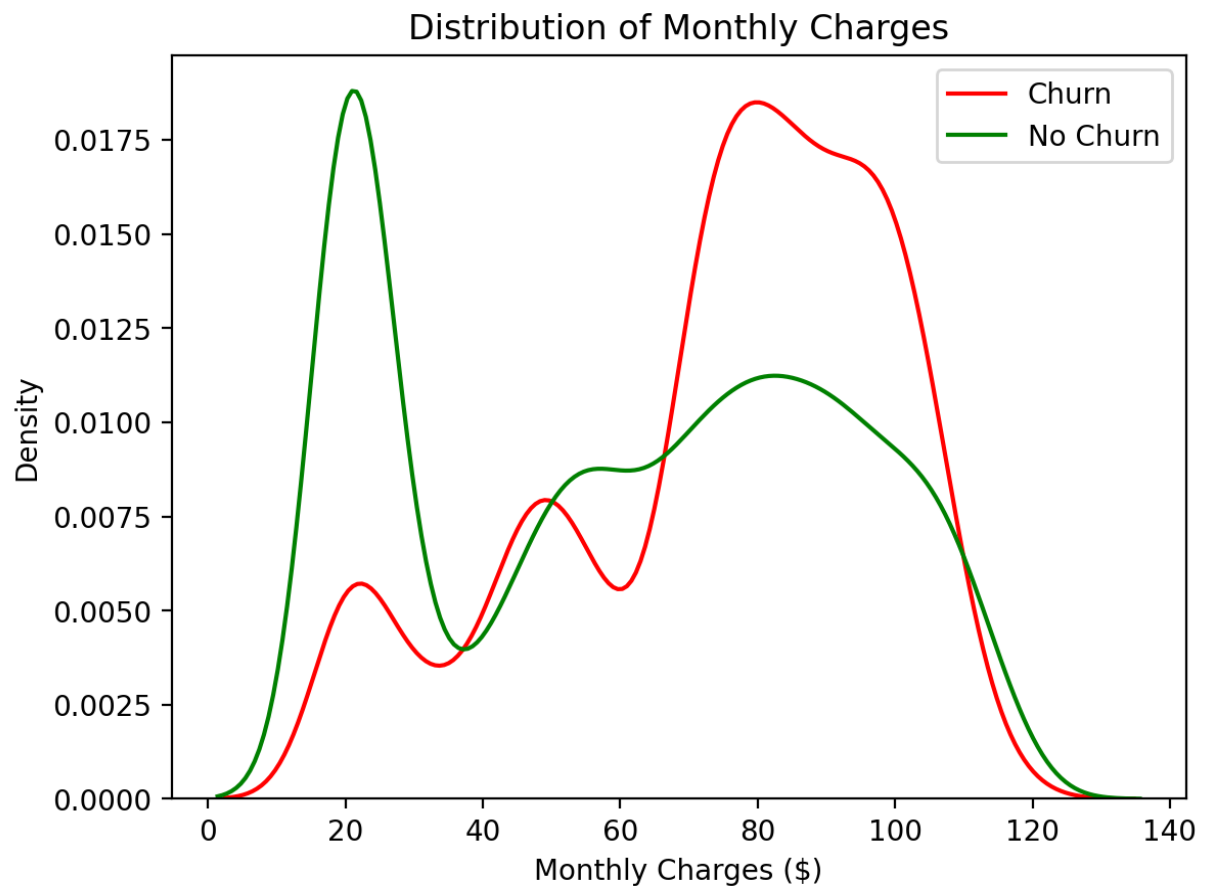
### Insights from the Data:



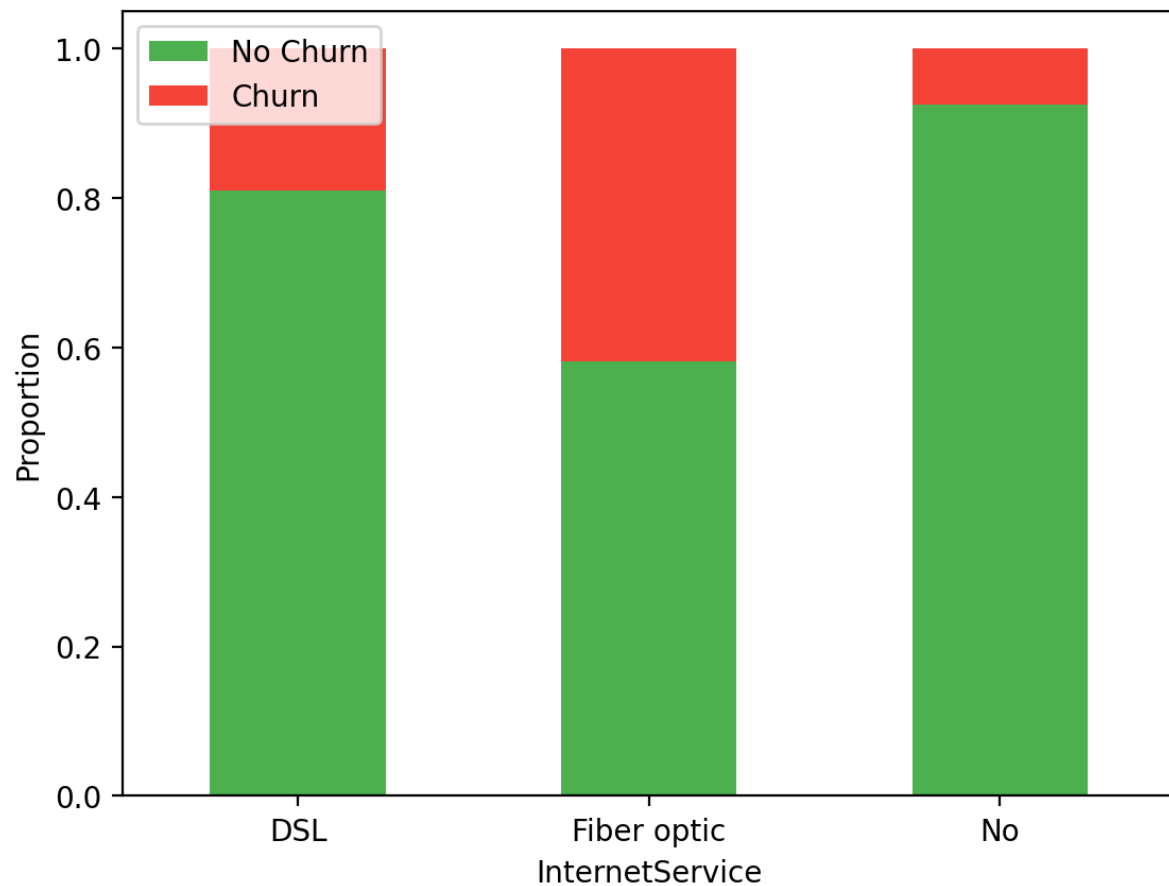
- **Insight 1: Contract Type is the Strongest Predictor** As seen in the "Churn by Contract" chart, customers on a **Month-to-month** plan have a dramatically higher churn rate than those on one or two-year contracts. Long-term contracts are a powerful retention tool.



- **Insight 2: New Customers are the Most At-Risk** The "Churn by Tenure" chart clearly shows that customers in their first year (**0-12 months**) are the most likely to leave. The churn rate steadily decreases as customer loyalty builds over time.



- **Insight 3: High Monthly Charges Increase Churn** The "Distribution of Monthly Charges" plot reveals that customers who churn typically have higher monthly bills. The churn distribution peaks in the \$80-\$100 per month range, indicating potential price sensitivity or value-for-money concerns at premium price points.



- **Insight 4: Fiber Optic Service Has a High Churn Rate** Interestingly, the "Churn by Internet Service" chart shows that customers with **Fiber optic** service are more likely to churn than those with DSL. This may suggest issues with service reliability, pricing, or competition for high-speed internet customers.

## Model Performance & Recommendations

### Final Model Performance

The final system is powered by a fine-tuned **Logistic Regression model**. It was specifically chosen and optimized to maximize **Recall**, the most critical metric for this business problem. The final model achieves:

- **Recall: 79%** (Successfully identifies 79 out of every 100 customers who are planning to churn).
- **F1-Score: 61%** (The best overall balance between precision and recall).

## Strategic Recommendations

Based on the insights from the dashboard, the following actions are recommended:

1. **Target Month-to-Month Customers:** Proactively launch a marketing campaign to incentivize customers on month-to-month plans to upgrade to one or two-year contracts, perhaps by offering a loyalty discount.
2. **Implement a New Customer Onboarding Program:** Since customers with low tenure are most at-risk, create a dedicated onboarding program for the first 12 months to ensure they are getting maximum value from their services and to build loyalty early.
3. **Investigate the Fiber Optic Experience:** The high churn rate among fiber optic customers warrants a deeper investigation. The business should analyze service reliability, pricing structure, and competitor offerings for this specific segment to address the underlying issues.