

TELCO CUSTOMER CHURN PREDICTION ANALYSIS

Leveraging Machine Learning for Proactive Customer Retention

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AGENDA

- Introduction
- Business Understanding
- Data Overview
- Exploratory Data Analysis
- Data Preprocessing
- Machine Learning Modelling
- Model Performance Comparison
- Feature Importance Analysis
- Business Recommendations
- Next Steps

BUSINESS UNDERSTANDING

► OBJECTIVE:

Predict customer churn to enable proactive retention strategies

► CONTEXT:

Telecom company faces ~26.6% churn (1,869/7,043 customers).

► KEY QUESTIONS:

- What are the key factors drive churn?
- How accurately can we identify at-risk customers?

► SUCCESS METRICS

- ROC AUC ≥ 0.80
- Precision & Recall balance for churn class

DATA OVERVIEW

ASPECT	DETAILS
TOTAL RECORDS	7,043 Customers
FEATURES	21 Variables (demographics, services,billing)
TARGET VARIABLE	Churn (Yes / No)
CHURN RATE	26.6% Positive Class
DATA QUALITY	11 missing values in TotalCharges (0.15%)

Key Feature Categories

- Demographics: Gender, Senior Citizen, Partner, Dependents
- Services: Phone, Internet, Security, Streaming, etc.
- Contract: Month-to-month, One year, Two year
- Billing: Payment method, Paperless billing, Charges

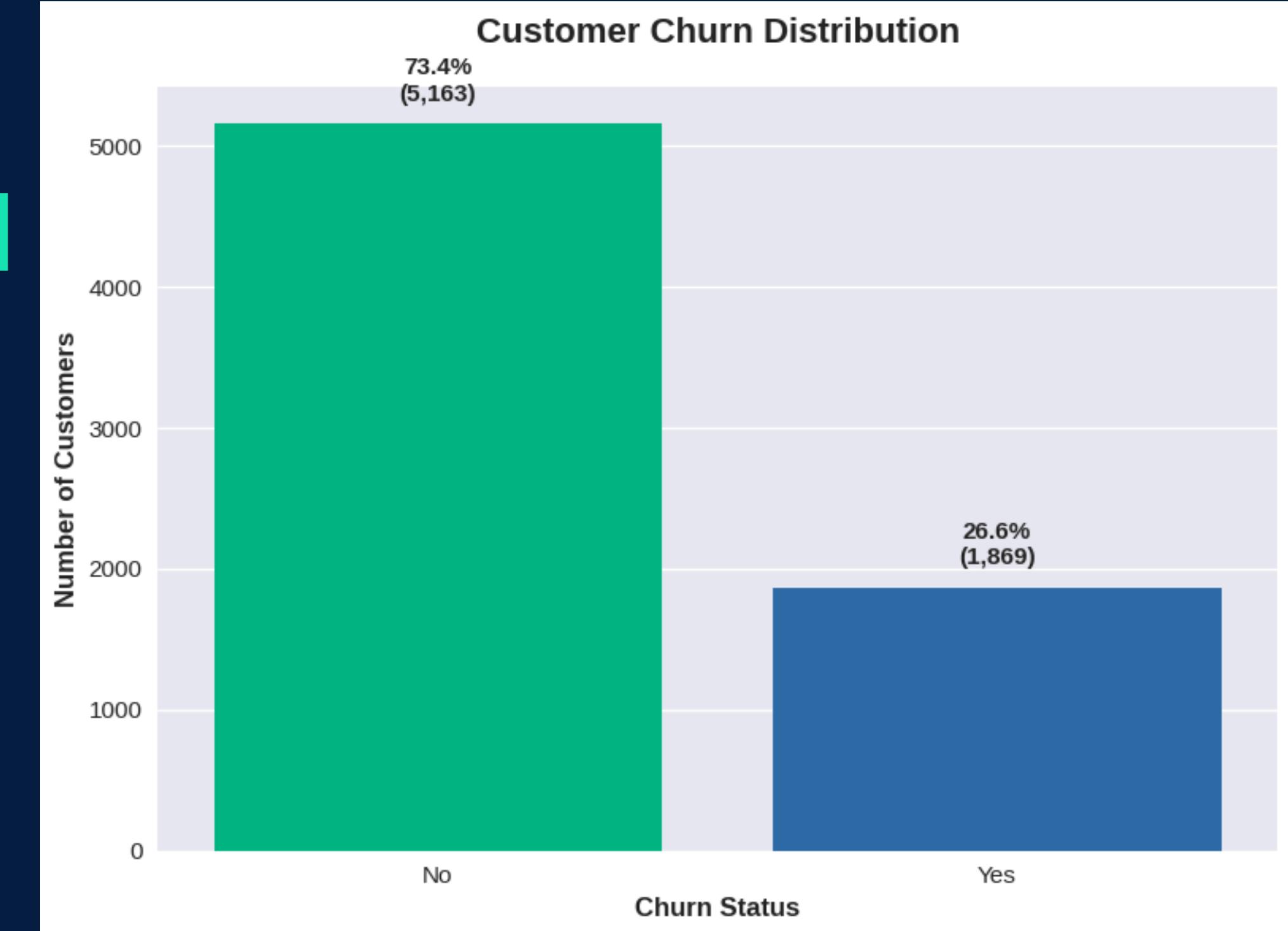


EXPLORATORY DATA ANALYSIS

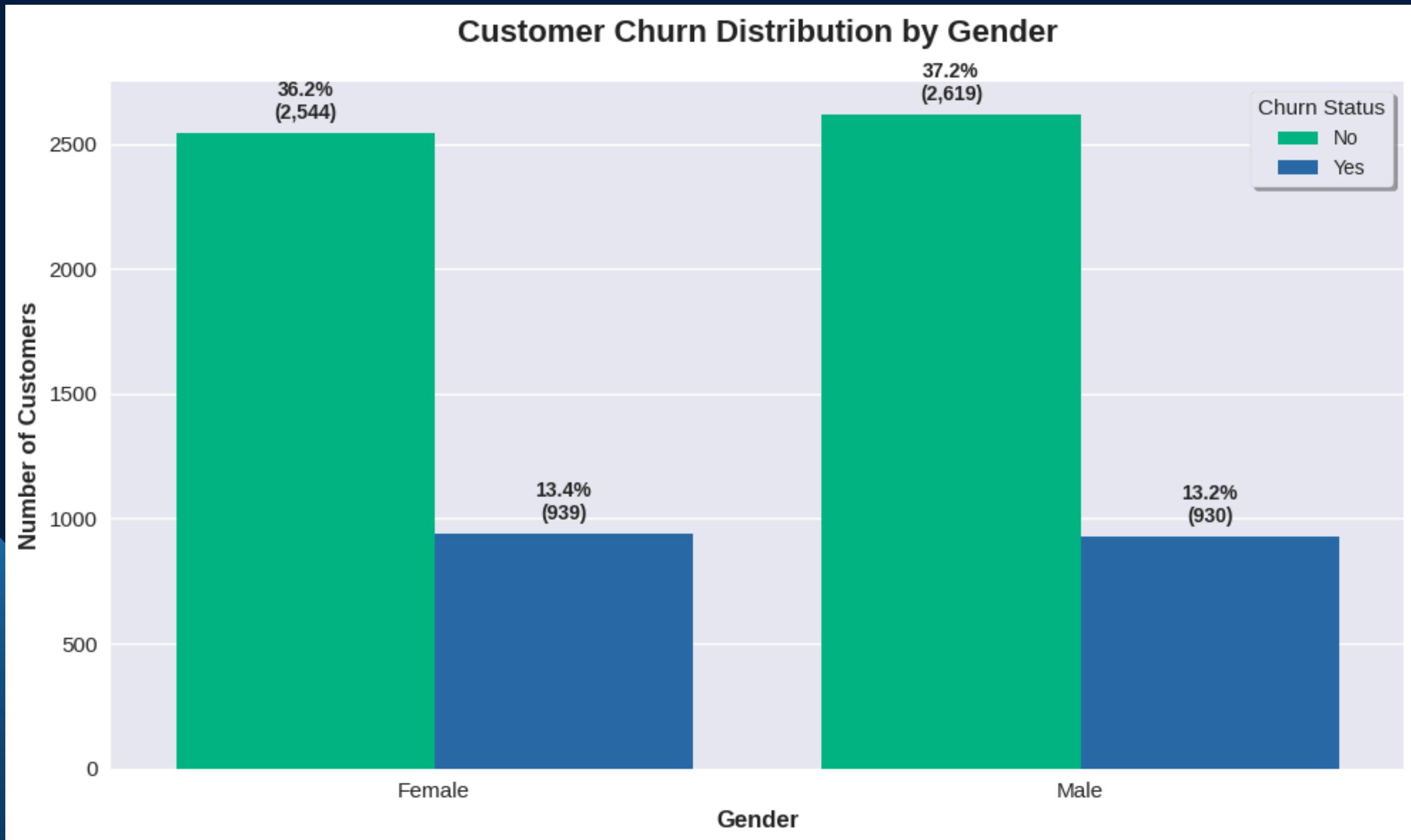


CHURN DISTRIBUTION

- 26.6% of customers churned (1,869 out of 7,032 customers)
- Majority of customers (73.4%) remain retained



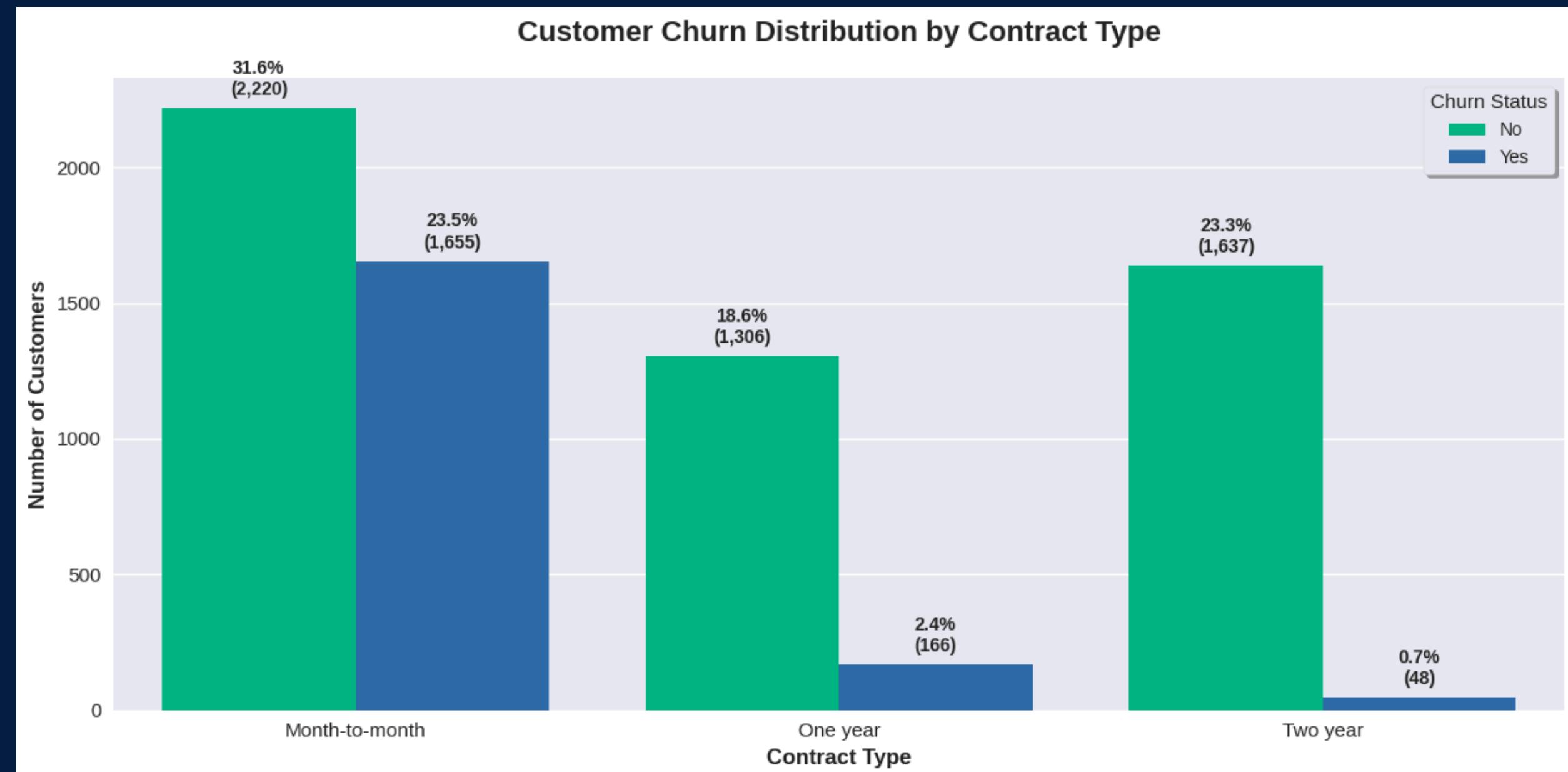
CHURN DISTRIBUTION BY GENDER



- Churn rates are nearly identical across genders
 - Female: 13.4% churn rate
 - Male: 13.2% churn rate
 - Gender is not a significant predictor of churn

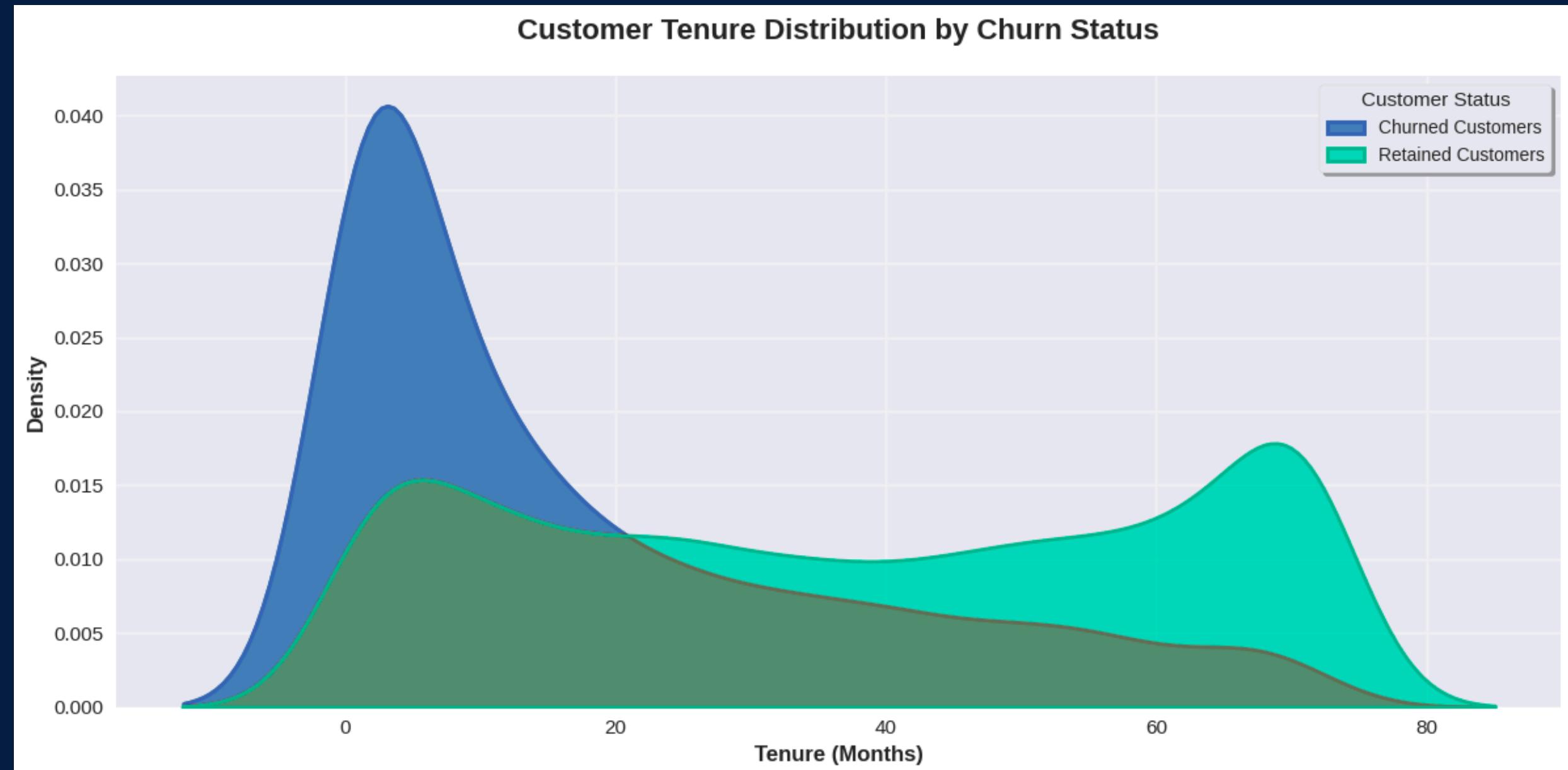
CONTRACT TYPE IMPACT

1. Month-to-month contracts show highest churn risk (23.5% of churned customers)
2. Longer contracts significantly reduce churn:
 - One-year contracts: Only 2.4% churn rate
 - Two-year contracts: Only 0.7% churn rate

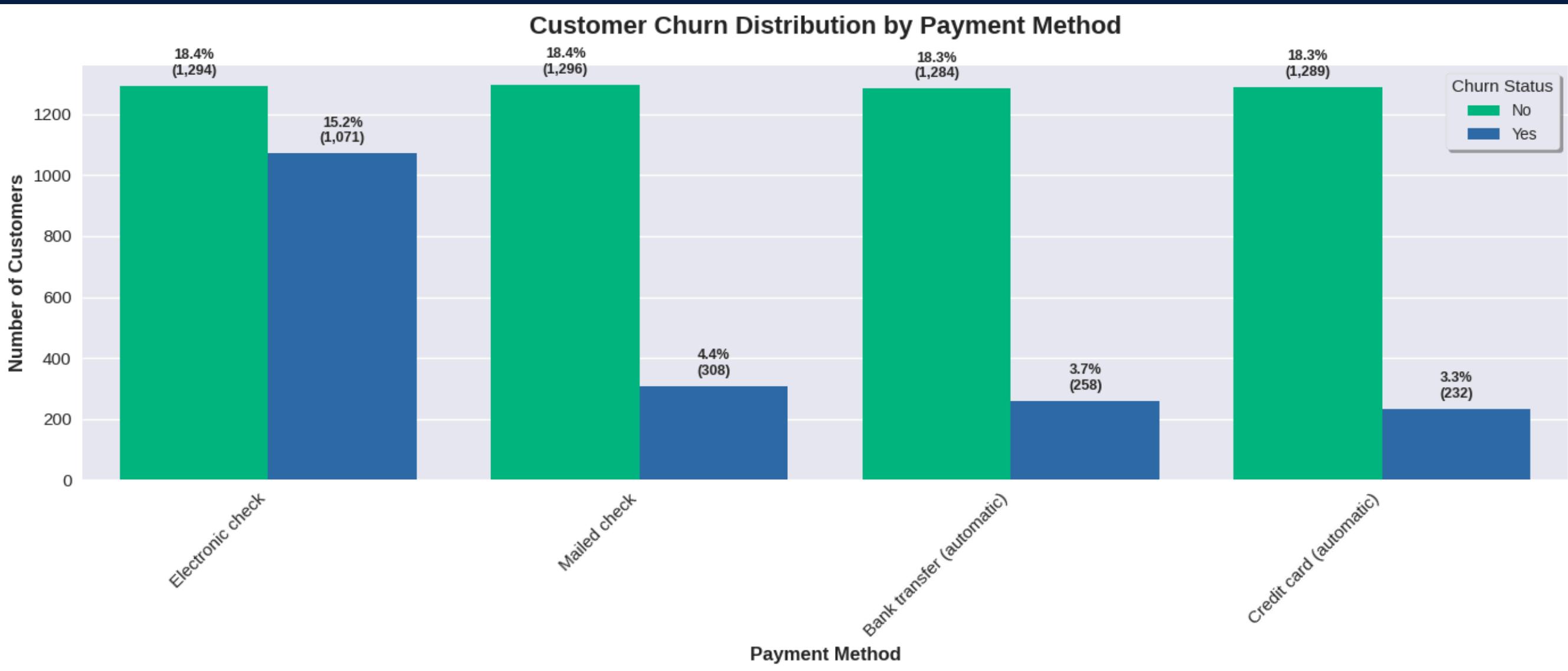


CUSTOMER TENURE PATTERNS

- New customers are most likely to churn (peak around 0-10 months)
- Long-term customers show higher retention (retention increases after 50+ months)
- Clear inverse relationship between tenure and churn probability

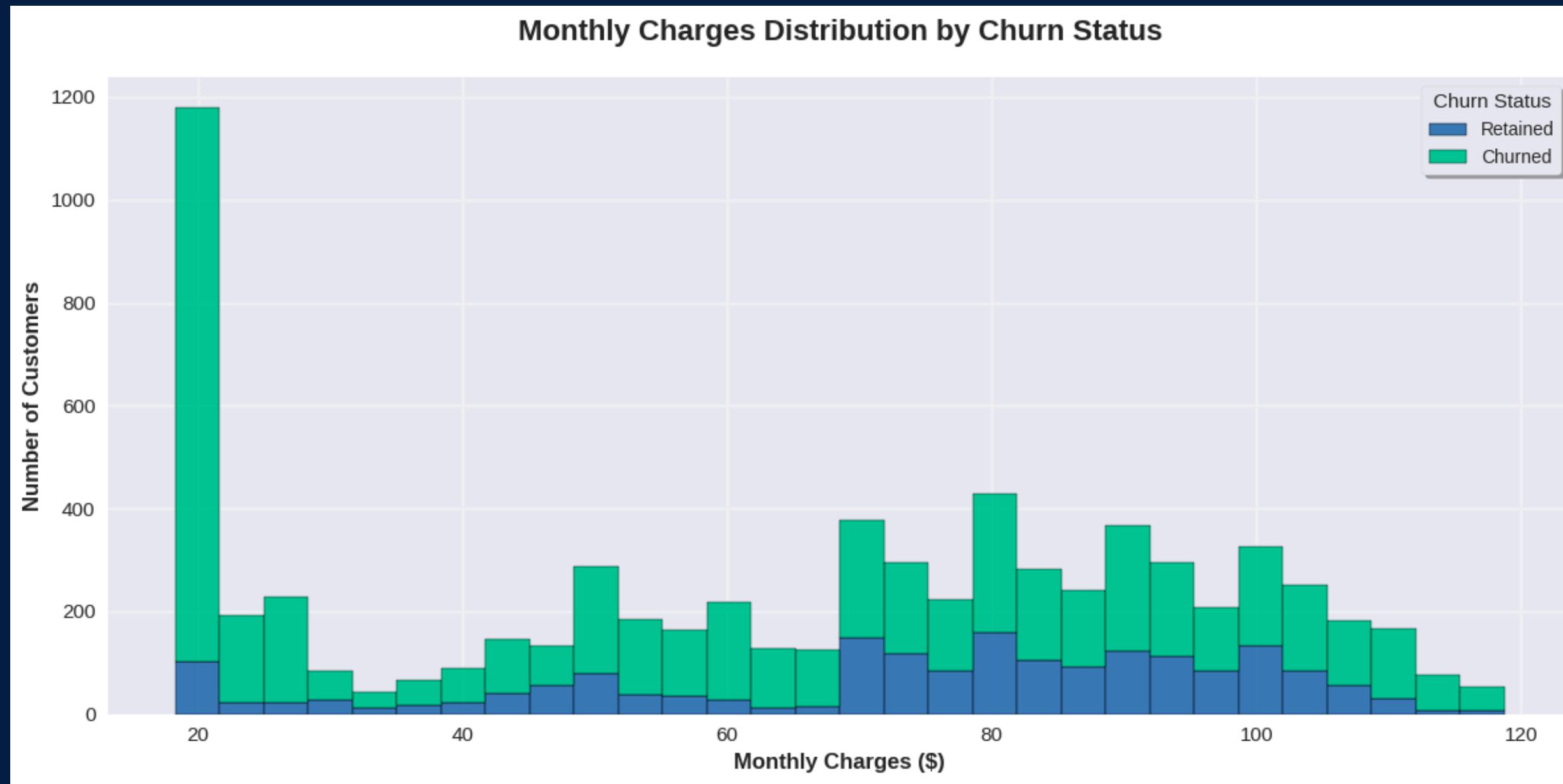


PAYMENT METHOD ANALYSIS



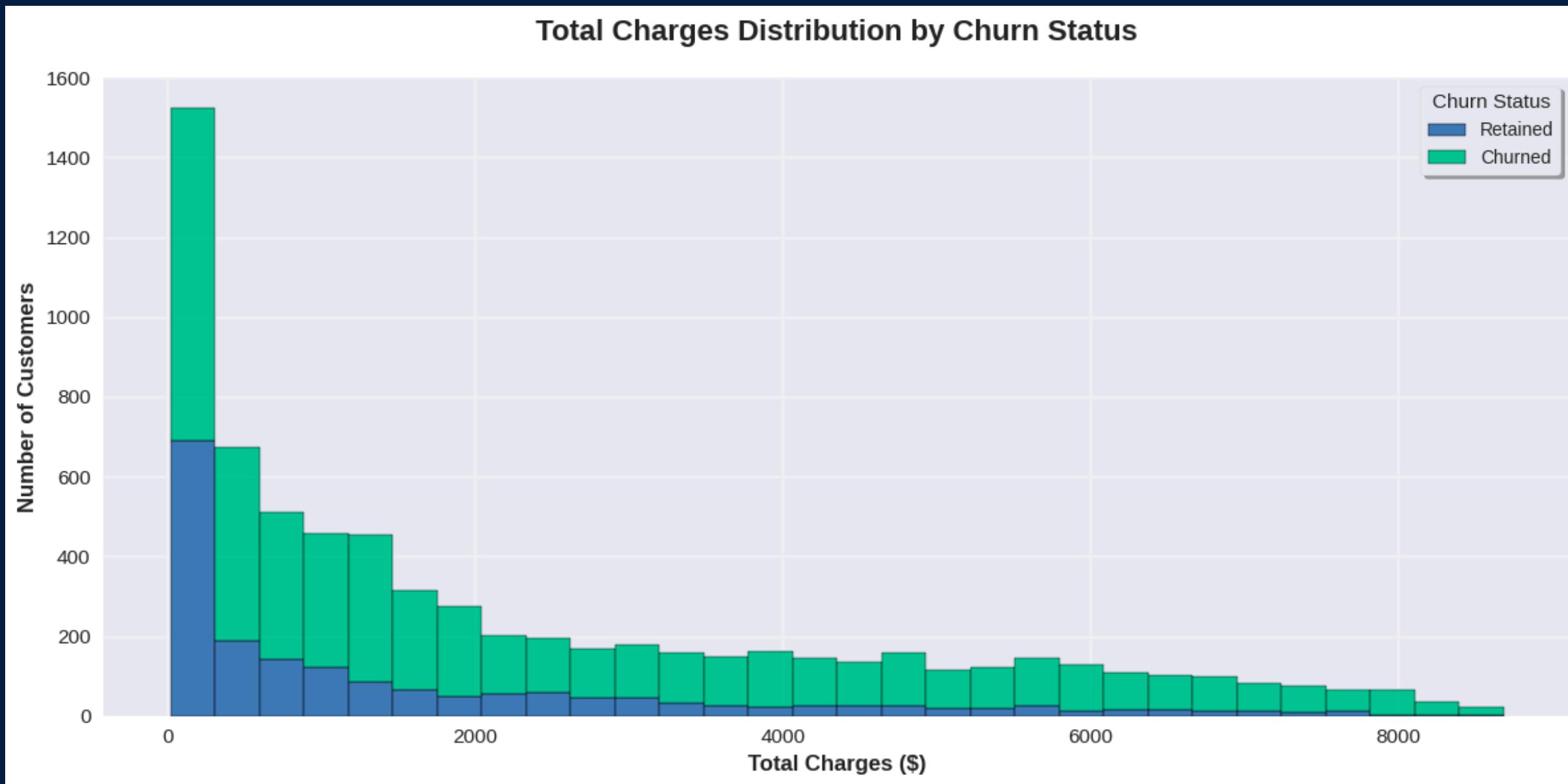
- Electronic check users have significantly higher churn (15.2% vs 3-5% for other methods)
- Automated payment methods show lower churn rates
- Manual payment correlates with higher churn risk
- Electronic check suggests less committed customers who may switch providers more easily, indicating payment convenience affects retention.

MONTHLY CHARGES IMPACT



- Lower monthly charges correlate with higher churn (~\$20 range shows highest churn)
- Mid-range charges (\$70-90) have better retention
- Suggests basic service customers are more price-sensitive and prone to switching

TOTAL CHARGES ANALYSIS



- Churned customers cluster heavily in low total charges (high peak near \$0-1000)
- Retained customers spread across higher total charge ranges
- Indicates churned customers leave before accumulating significant lifetime value

DATA PREPROCESSING

01

Data Cleaning

- Converted TotalCharges to numeric format
- Removed 11 customers with missing values (new customers)
- Dropped customerID (non-predictive identifier)

02

Feature Engineering

- Binary encoding: Yes/No variables → 1/0
- Categorical encoding: One-hot encoding for multi-class variables
- Standardization: Numerical features scaled for model compatibility

03

Class Imbalance Handling

- SMOTE: Synthetic Minority Oversampling Technique
- Stratified sampling: Maintained class distribution in train/test split
- Class weights: Balanced approach in model training



MACHINE LEARNING MODELLING

MODEL PERFORMANCE COMPARISON

Model	ROC AUC	Precision	Recall	Accuracy
Baseline Logistic Regression	0.834	0.497	0.775	0.732
Random Forest	0.815	0.575	0.594	0.775
XGBoost	0.810	0.500	0.709	0.734
Tuned and Calibrated LR	0.836	0.649	0.559	0.802

Why Tuned Logistic Regression won

- **Highest ROC AUC:** Best discrimination capability
- **Highest Precision:** Most efficient for targeted campaigns
- **Best Accuracy:** 80% of predictions correct
- **Interpretability:** Clear coefficient-based insights

FEATURE IMPORTANCE ANALYSIS

Key Churn Drivers

FACTORS THAT INCREASE CHURN RISK

- Partner (0.759) - Customers with partners churn more
- MonthlyCharges (0.612) - Higher bills drive departures
- OnlineSecurity (0.366) - Service satisfaction issues
- PaymentMethod_Mailed check (0.293) - Automatic payment preference
- PaymentMethod_Electronic check (0.250) - Automatic payment preference

FACTORS THAT DECREASE CHURN RISK

- PaperlessBilling (-1.455) - Strongest retention factor
- SeniorCitizen (-1.276) - Older customers more loyal
- PhoneService (-0.855) - Core service creates stickiness
- Dependents (-0.801) - Family responsibilities reduce churn
- Contract_Two year (-0.489) - Long-term commitment

BUSINESS RECOMMENDATIONS

01

Price & Billing Strategy

- Monitor high monthly charge customers - implement loyalty discounts before they churn
- Promote paperless billing with incentives - strongest retention factor
- Migrate customers from manual payment methods to auto-pay with rewards

02

Service & Engagement Strategy

- Target partner households with family plans or shared benefits
- Improve online security service quality and communication of value
- Focus retention on younger demographics (since seniors are naturally more loyal)

03

Contract & Loyalty Programs

- Incentivize longer-term contracts - two-year contracts significantly reduce churn
- Bundle phone service with internet - creates stronger customer relationships
- Family-focused retention for customers with dependents

NEXT STEPS



MODEL ENHANCEMENT

Implement advanced feature engineering with interaction terms, ensemble methods combining multiple algorithms, and real-time scoring capabilities for streaming predictions.



BUSINESS INTELLIGENCE INTEGRATION

Develop Customer Lifetime Value modeling, retention campaign ROI tracking, and cohort analysis to prioritize interventions and understand long-term churn patterns.



EXPERIMENTAL DESIGN

Launch A/B testing framework with control and treatment groups receiving targeted offers based on churn drivers, measuring success through churn reduction and revenue impact.

THANK YOU

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[project repository](#)



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