

Customer Churn Analysis

Predictive Analytics & Business Intelligence

Complete Analysis: Data Prep | EDA | Segmentation | Prediction | Recommendations

Dataset Overview

7,043

Dataset Size

26.4%

Overall Churn

20

Features Analyzed

4

Models Tested

Project Objectives





1. Analyze customer churn patterns in a telecommunications industry
2. Segment customers based on behavior and value
3. Develop predictive models to identify at-risk customers
4. Provide actionable business recommendations for retention

Task 1: Data Preparation

Dataset Overview

7,043 customer records

20 features including:

- Demographics  (gender, senior citizen, Partner)
- Services  (internet, phone, streaming)
- Account info  (tenure, contract, payment method)
- Financials  (Charges)
- Target: Churn (Yes/No)

Missing values: Total Charges column

Data Cleaning

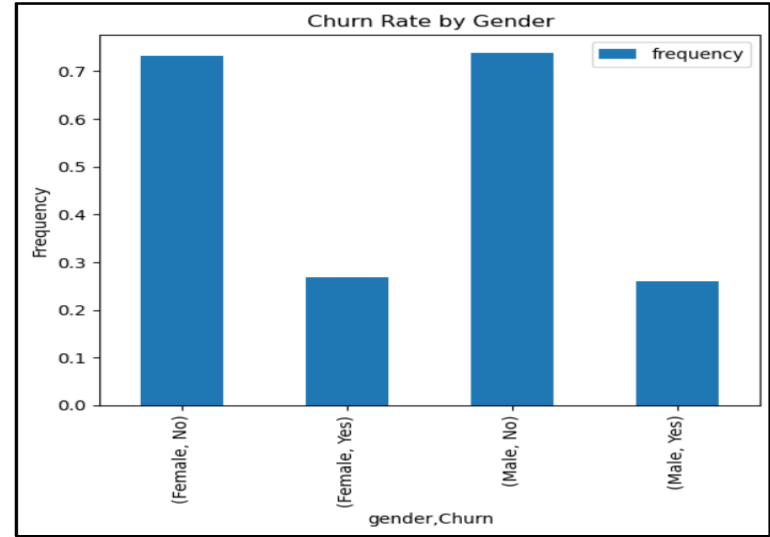
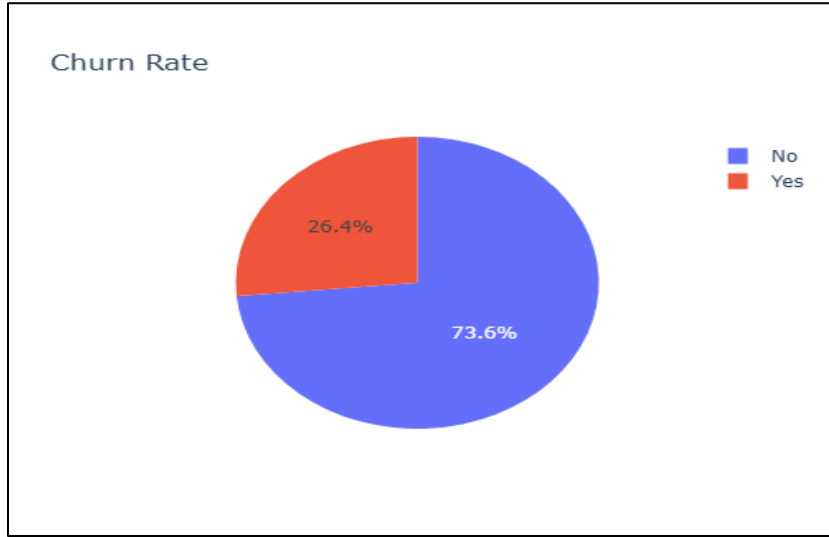
For EDA:

- ✓ Removed duplicate records
- ✓ Handled missing Total Charges (mean imputation)

For Model:

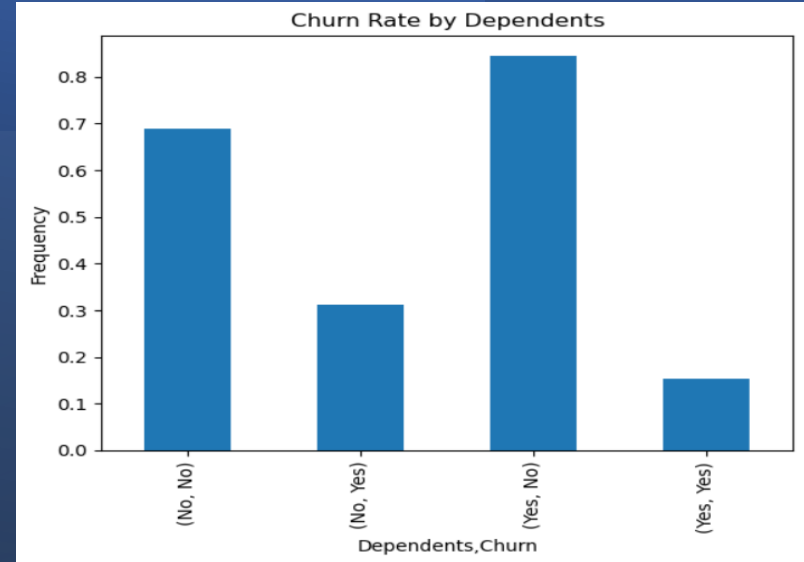
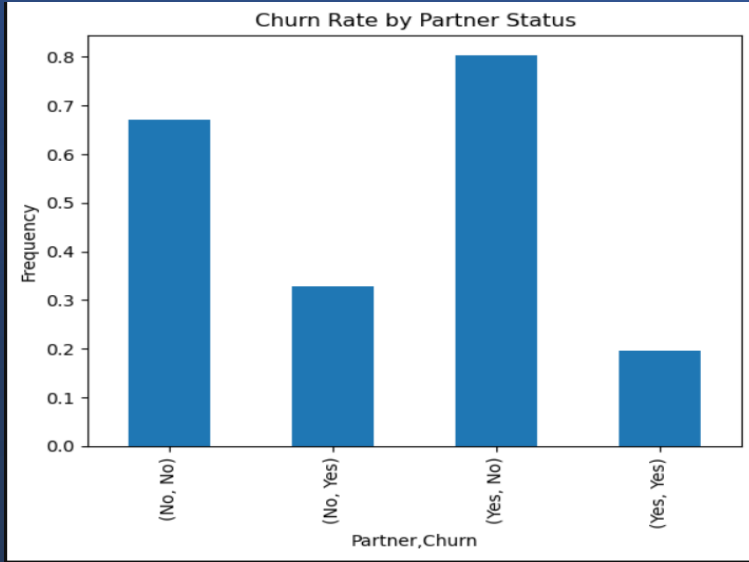
- ✓ Encoded categorical variables
- ✓ Split data: 80% train, 20% test
- ✓ Oversampled X_train
- ✓ Standardized tenure and monthly charges columns

Task 2: Exploratory Data Analysis



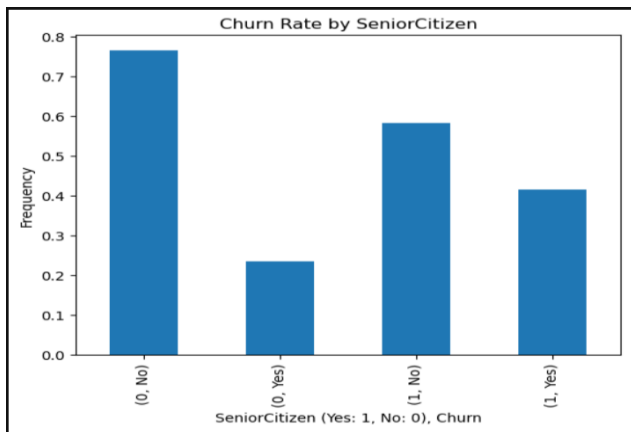
- Churn Rate (26%)
- There is no significant difference between churn rates by gender.

Churn Rate by Partner Status and Dependents



- Churn Rate is higher customers who have no Partners and Dependents

Churn Rate by Senior Citizen and Tenure Distribution

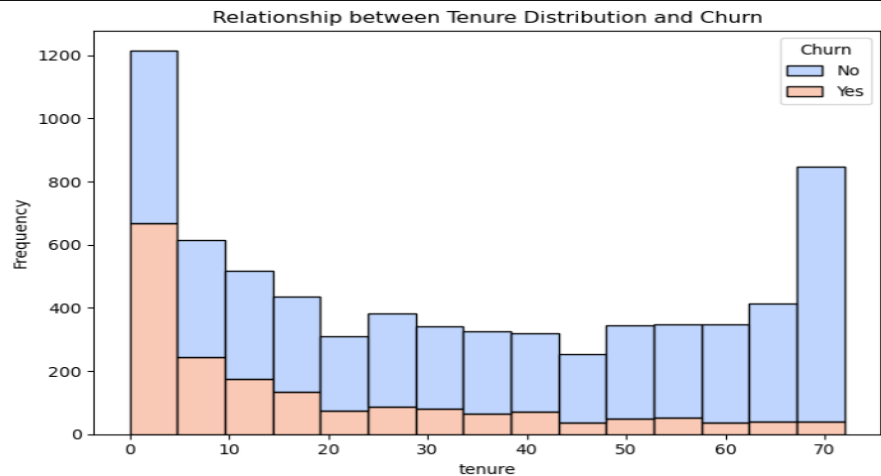
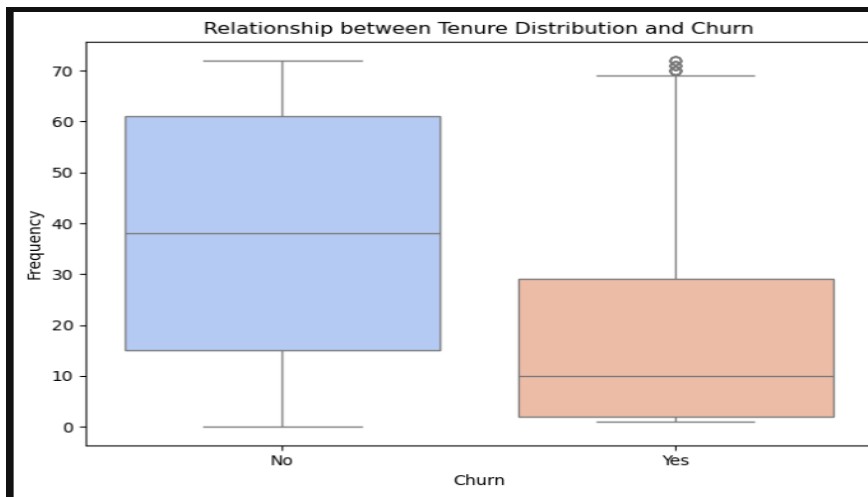


Churn seem higher among Senior Citizen

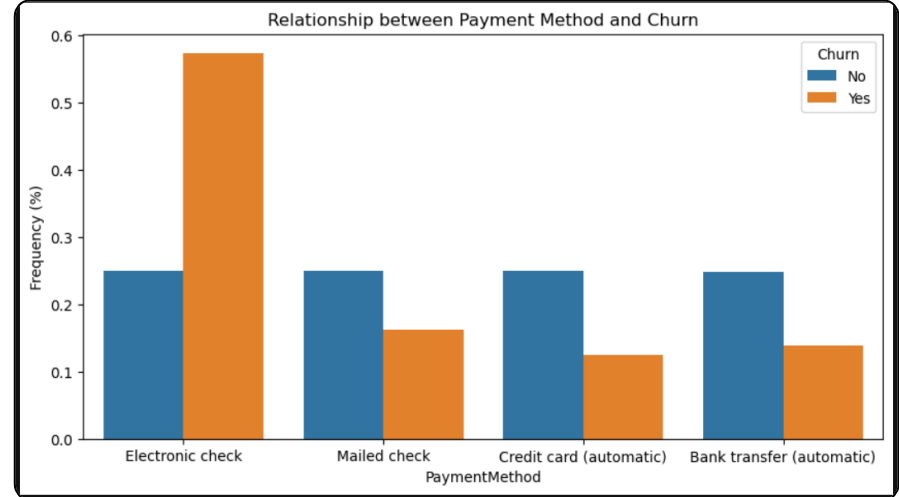
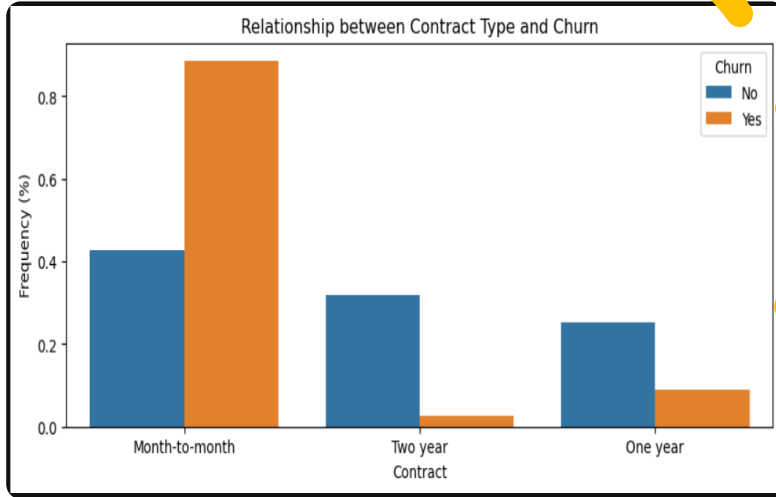
Customers who did not churn have a higher median tenure and broader tenure range, suggesting long-term customers are more stable and less likely to cancel.

Churned customers generally have lower median and shorter tenures. Mostly under 20 months, indicating newer customers are more likely to leave.

Churn frequency is highest among short-tenure customers and gradually decreases as tenure increases, while non-churned customers dominate the longer tenure ranges.



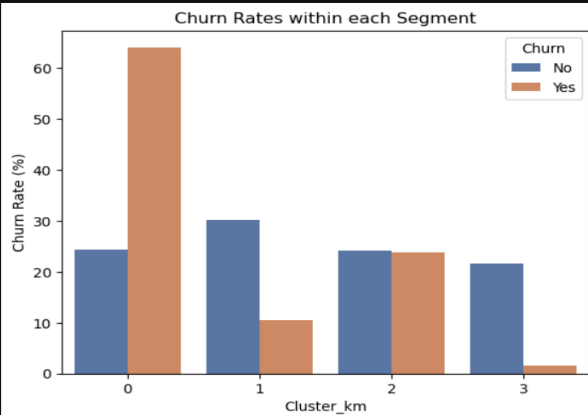
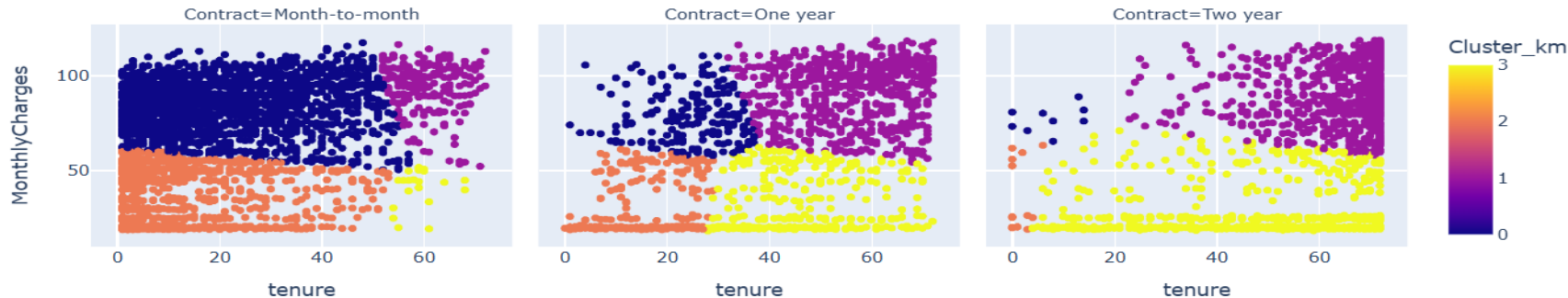
Churn Rate by Contract type and Payment Method



- Customers on month-to-month contracts show the highest churn rate. This indicates that shorter contract durations and tenures are linked to higher customer attrition.
- Churn rate is highest among customers who use the electronic check payment method

Customer Segmentation

Customer Segmentation in 2D: Tenure vs Monthly Charges vs Contract Type



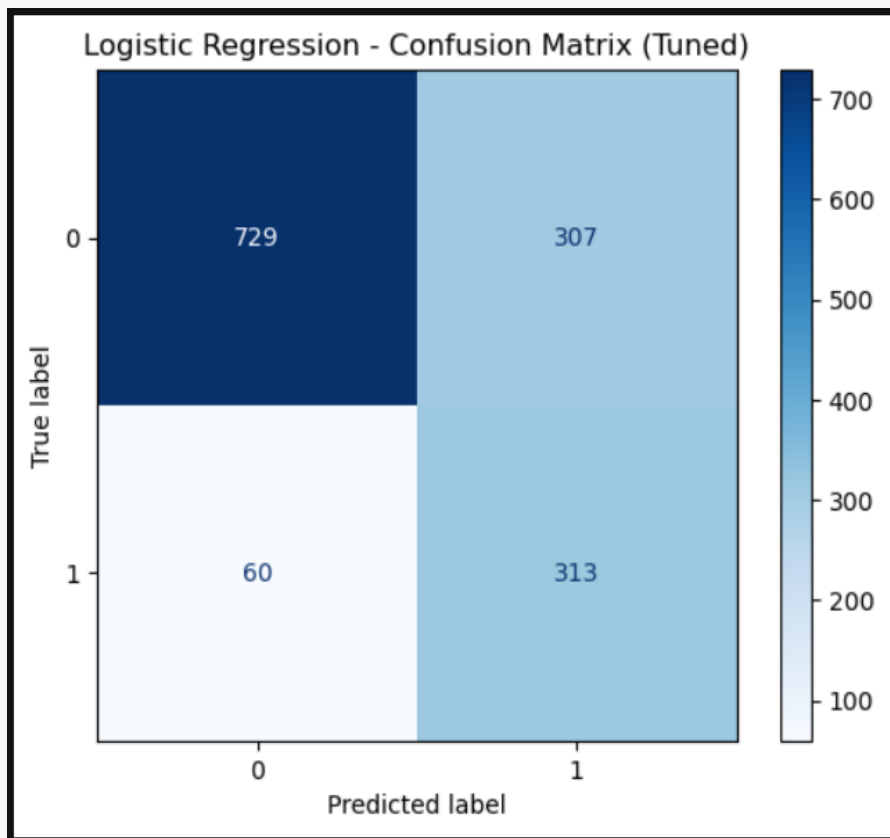
Cluster 0 (Short Contract and Medium/High Charges): High Risk (Mostly in Month-to-Month Contract type).

Cluster 1 (Long Contracts and High Charges): Loyal Premium (Dominated in One- and Two-year Contract types).

Cluster 2 (Month to Month and Low Charges): New Low Spend (Dominated in short Contract types and low Monthly Charges).

Cluster 3 (Long Contracts and moderate Charges): Stable Long-Term

Predictive Modeling

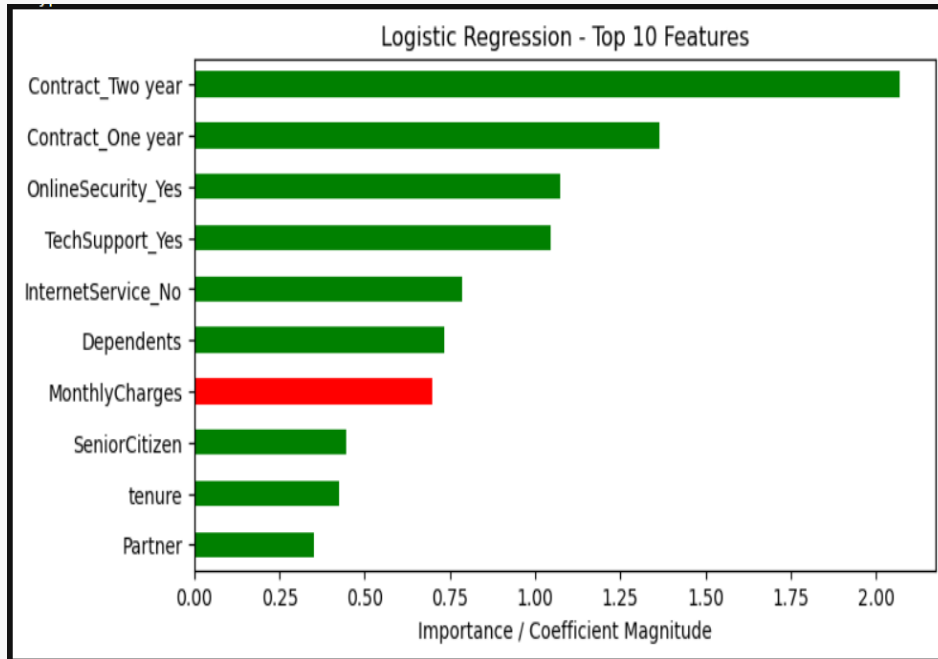


Machine Learning Model Evaluated

- Logistic Regression (ROC-AUC = 0.841)
 - Decision Tree (ROC-AUC = 0.784)
 - XGBoost (ROC-AUC = 0.819)
 - Random Forest (ROC_AUC = 0.819)
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- Logistic Regression model is chosen because of its high ROC-AUC and churn recall (better at catching churners) compared to other models.

	Precision	Recall	F1	Support
0 (No Churn)	0.92	0.70	0.80	1036
1 (Churn)	0.50	0.84	0.63	373

Top 10 Churn Predictors



- Top churn driver: High Monthly Charges
- Top retention drivers: long contracts, tech/security add-ons, dependents, tenure, senior citizen, etc

Model Insights & Interpretation



Price Sensitivity

High monthly charges are the strongest churn predictor. Customers paying premium prices need exceptional value delivery.



Service Quality

Offer protective Services to high-risk customers since these services lower churn risk



Contract

Promote longer contract options to both new and existing customers

Task 6: Strategic Recommendations

A. Targeted Retention

1. Focus on Cluster 0 and month-to-month customers
2. Personalized offers for high monthly charge customers
3. Bundle promotions for fiber optic & streaming users
4. Contract upgrade incentives with added value

B. Customer Engagement

1. Proactive outreach to high-risk segments
2. Feedback collection from churn-prone groups
3. Incentivize autopay & credit card payments
4. Early warning system based on model predictions

C. Marketing & Product

1. Win-back campaigns for recent churners
2. Referral programs leveraging Cluster
3. Service quality improvements for fiber optic
4. Simplify add-on services & improve value perception

Key Takeaways

- ✓ 26.4% churn rate represents significant risk & opportunity
- ✓ 347 high-value customers need immediate attention
- ✓ Price is a primary churn drivers
- ✓ Month-to-month contracts = highest vulnerability
- ✓ Targeted strategies can reduce churn by 15-20%