**DETAILED REPORT**  
**Service Usage Analysis & Customer Churn Prediction for a Telecommunications Company**

**1. Introduction**

The purpose of this report is to:

1. **Analyze customer service usage behavior** across core and add-on services: voice, Internet, and additional packages (security, backup, device protection, tech support, streaming).
2. **Build a churn prediction model** to identify customers at high risk of leaving and propose retention strategies.

**2. Data Overview**

| **Feature Category** | **Variables** |
| --- | --- |
| **Demographics** | gender, SeniorCitizen, Partner, Dependents |
| **Core Services** | PhoneService, MultipleLines, InternetService |
| **Add-on Services** | OnlineSecurity, OnlineBackup, DeviceProtection, TechSupport, StreamingTV, StreamingMovies |
| **Billing & Contract** | Contract, PaperlessBilling, PaymentMethod |
| **Usage & Charges** | MonthlyCharges, TotalCharges, Tenure |
| **Target** | Churn (Yes/No) |

**Summary**

* Total customers: 7,043, with a churn rate of 26.54%.
* Gender distribution: Male 50.48%, Female 49.52%.
* Senior citizens: 16.21%; Customers with a partner: 48.30%; Customers with dependents: 29.96%.

**3. Service Usage Analysis**

**3.1. Voice Services**

* 90.32% of customers subscribe to basic phone service; among them, 42.18% have multiple lines.
* Multiple-line customers generate higher ARPU but are also more sensitive to service quality and price.

**3.2. Internet & Add-on Services**

| **Service Type** | **Adoption Rate (%)** | **Notes** |
| --- | --- | --- |
| Fiber Optic | 43.96 | High ARPU but high churn if quality is poor |
| DSL | 34.37 | Lower-priced, more stable |
| No Internet Service | 21.67 | Opportunity for cross-selling |
| Online Security | 28.67 | Upsell potential: 49.67% of customers not yet enrolled |
| Online Backup | 34.49 | Moderate demand, 43.84% growth potential |
| Device Protection | 34.39 | Strong upsell opportunity |
| Tech Support | 29.02 | Improves customer experience and reduces churn |
| Streaming TV | 38.44 | Competes with OTT platforms; 39.90% untapped potential |
| Streaming Movies | 38.79 | Similar dynamics to Streaming TV |

**Insights**

* Add-on services boost ARPU and enhance customer engagement, lowering churn.
* Focus upselling on customers with fiber connections and promote multi-add-on bundles.

**4. Relationship Between Features and Churn**

**4.1. Numerical Features**

* **Tenure**: Average tenure for churners is 17.98 months vs. 37.57 months for non-churners.
* **MonthlyCharges**: Churners pay an average of $74.44 vs. $61.27 for non-churners.
* **TotalCharges**: Churners $1,531.80 vs. $2,555.34 for non-churners.

**Correlations**

* Tenure & TotalCharges: r = 0.83 (high multicollinearity)
* MonthlyCharges & TotalCharges: r = 0.65
* Tenure & MonthlyCharges: r ≈ 0

**4.2. Categorical Features (Chi-square Tests)**

| **Feature** | **P-value** | **Significance to Churn** |
| --- | --- | --- |
| Gender | 0.4866 | Not significant |
| PhoneService | 0.3388 | Not significant |
| SeniorCitizen | <0.0001 | Significant |
| Partner | <0.0001 | Significant |
| Dependents | <0.0001 | Significant |
| MultipleLines | 0.0035 | Significant |
| InternetService | <0.0001 | Significant |
| Add-on Services | <0.0001 | Significant |
| Contract | <0.0001 | Significant (Month-to-month highest) |
| PaperlessBilling | <0.0001 | Significant |
| PaymentMethod | <0.0001 | Significant (Electronic check highest) |

**Conclusion**  
Contract type, Internet service type, add-ons, and payment method have the strongest impact on churn.

**5. Churn Prediction Modeling**

**5.1. Algorithm Selection**

* **XGBoost** outperforms with F1-score ≈ 0.84 and ROC AUC ≈ 0.99, handling missing values and outliers effectively and offering interpretability via SHAP.

**5.2. Preprocessing & Feature Engineering**

1. Drop customerID and TotalCharges (multicollinear with Tenure & MonthlyCharges).
2. Encode categorical variables (binary & one-hot).
3. Scale MonthlyCharges and Tenure.
4. Create interaction features:
   * Tenure\_bucket × Contract\_TwoYear
   * FiberOptic × StreamingTV

**5.3. Top 10 Important Features**

1. Contract\_Month-to-month
2. InternetService\_Fiber Optic
3. OnlineSecurity\_No
4. InternetService\_DSL
5. TechSupport\_No
6. PaymentMethod\_ElectronicCheck
7. Contract\_TwoYear
8. StreamingMovies\_Yes
9. Contract\_OneYear
10. StreamingMovies\_No

**6. Retention Strategy Recommendations**

1. **Convert Month-to-Month → Long-Term Contracts**: Offer 15–20% discount for 12/24-month plans plus add-on trials.
2. **Upsell Add-on Bundles**: “All-in-One” package with 25% discount for 2+ add-ons.
3. **Fiber + Streaming Bundles**: 100 Mbps + streaming from $19.99/month, include 3-month Netflix/HBO trial.
4. **Promote Auto-Pay**: 5% first-bill discount and 100 reward points.
5. **Senior Citizen Care**: Priority hotline, educational webinars, 20% service discount.
6. **Early Engagement (0–6 months)**: Sequence of emails/SMS with add-on promotions and a follow-up call at 30 days.
7. **Leverage Paperless Billing**: Flash sales and interactive CTAs via email.
8. **Family Plans**: 4 lines + 200 GB shareable, priced at only 15% above 2-line plan.

Each strategy should have clear KPIs (e.g., conversion ≥30%, upsell ≥35%, auto-pay ≥60%, 6-month retention ≥90%).

**7. Conclusion**

EDA reveals that contract type, fiber Internet service, add-ons, payment method, and tenure are key drivers of churn. Implementing an XGBoost model with these features enables accurate churn prediction and supports targeted retention strategies focusing on high-value and at-risk segments.