**End-to-End Customer Churn Analysis & Prediction Project Report**

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**Executive Summary**

This report presents a comprehensive end-to-end customer churn analysis project for a telecom company dataset. Using advanced data analytics and machine learning techniques, I successfully analyzed customer behavior patterns, identified key churn drivers, and built a predictive model to proactively identify at-risk customers.

**Key Achievements:**

* Analyzed 6,418 customer records with 27.0% churn rate
* Identified 378 high-risk customers from 411 new joiners
* Achieved 84% accuracy in churn prediction model
* Created interactive dashboards for business decision-making
* Delivered actionable recommendations to reduce customer attrition

This project demonstrates my ability to transform raw business data into strategic insights that drive customer retention and revenue protection initiatives.

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**1. Project Overview**

Customer churn represents a critical challenge in the telecom industry, where acquiring new customers costs 5-25 times more than retaining existing ones. This project addresses the business need for proactive churn management through comprehensive data analysis and predictive modeling.

**Project Scope:**

* Complete analysis of telecom customer database
* Development of interactive business intelligence dashboards
* Implementation of machine learning for churn prediction
* Creation of actionable business recommendations

**Business Impact:** The solution enables stakeholders to identify high-risk customers, understand churn drivers, and implement targeted retention strategies, potentially reducing churn by 15-20% through data-driven interventions.

**2. Business Objectives**

**Primary Goals:**

* **Analyze** customer churn patterns across demographics, services, and geography
* **Identify** high-risk customer segments for targeted retention campaigns
* **Predict** future churners using advanced analytics
* **Provide** interactive dashboards for ongoing business monitoring
* **Deliver** specific recommendations to reduce customer attrition

**Key Performance Indicators:**

|  |  |  |
| --- | --- | --- |
| **Metric** | **Value** | **Significance** |
| **Total Customers** | 6,418 | Complete customer base analyzed |
| **Total Churn** | 1,732 | Customers lost to competition |
| **Churn Rate** | 27.0% | Critical business metric |
| **New Joiners** | 411 | Fresh customers for prediction |

**3. Technologies Used**

|  |  |  |
| --- | --- | --- |
| **Component** | **Technology** | **Business Purpose** |
| **Data Storage** | Microsoft SQL Server | Secure, scalable customer data management |
| **Analytics & Visualization** | Microsoft Power BI | Interactive dashboards for stakeholder insights |
| **Predictive Modeling** | Python & Machine Learning | Advanced churn prediction capabilities |
| **Data Integration** | Excel & CSV workflows | Seamless data import/export processes |

**4. Dataset Analysis**

**Customer Profile Overview:**

* **Demographics:** Gender, age groups, marital status, geographic distribution
* **Service Usage:** Internet types, additional services, contract terms
* **Financial Metrics:** Monthly charges, total revenue, payment methods
* **Behavioral Data:** Tenure, referrals, service adoption patterns

**Data Quality Assurance:**

* Comprehensive data cleaning and validation
* Standardization of customer categories
* Handling of missing values and anomalies
* Creation of analytical data structures

**5. Key Findings & Insights**

**Summary Dashboard Analysis**

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**Overall Business Metrics:**

* **Customer Base:** 6,418 total customers
* **Churn Impact:** 1,732 customers lost (27.0% rate)
* **New Opportunities:** 411 new joiners analyzed
* **Revenue Risk:** Significant potential loss from high-value segments

**Critical Churn Patterns Identified:**

**Gender-Based Analysis:**

* **Female Customers:** 1,111 churns (64.15% of total churn)
* **Male Customers:** 621 churns (35.85% of total churn)
* **Insight:** Female customers require targeted retention strategies

**Age Group Impact:**

* **>50 Years:** Highest churn rate at 31.6%
* **20-35 Years:** 23.7% churn rate
* **36-50 Years:** 23.6% churn rate
* **<20 Years:** Minimal churn impact

**Contract Type Analysis:**

* **Month-to-Month:** Critical 46.5% churn rate
* **One Year:** Moderate 11.0% churn rate
* **Two Year:** Low 2.7% churn rate
* **Strategic Focus:** Convert short-term contracts to longer commitments

**Payment Method Risks:**

* **Mailed Check:** High-risk 37.8% churn rate
* **Bank Withdrawal:** Moderate 34.4% churn rate
* **Credit Card:** Low-risk 14.8% churn rate

**Geographic Hotspots:**

* **Jammu & Kashmir:** Extreme 57.2% churn rate
* **Assam:** High 38.1% churn rate
* **Jharkhand:** Elevated 34.5% churn rate
* **Chhattisgarh:** Concerning 30.5% churn rate
* **Delhi:** Above-average 29.9% churn rate

**6. Dashboard Solutions**

**Executive Summary Dashboard**

The main dashboard provides comprehensive business intelligence with key performance indicators and trend analysis:

**Key Visualizations:**

* Real-time KPI cards showing total customers, churn, and rates
* Gender-based churn distribution with clear percentage breakdowns
* Contract type analysis highlighting month-to-month risks
* Payment method comparison showing credit card advantages
* Age group analysis identifying senior customer vulnerabilities
* Geographic mapping of churn hotspots for regional strategies
* Service usage patterns revealing protection plan importance

**Interactive Features:**

* Dynamic filtering by monthly charge ranges
* Marital status segmentation options
* Drill-down capabilities for detailed analysis

**Service Analysis Insights:**

**Internet Service Impact:**

* **Fiber Optic:** High-risk 41.1% churn rate
* **Cable:** Moderate 25.7% churn rate
* **DSL:** Lower 19.4% churn rate
* **No Internet:** Minimal 7.8% churn rate

**Critical Service Gaps:**

* **Online Security:** 84.6% churn without this service
* **Device Protection:** 71.0% churn without protection
* **Online Backup:** 71.9% churn without backup service
* **Multiple Lines:** 54.8% churn without multiple lines

**Churn Category Breakdown:**

* **Competitor Issues:** 761 customers (44% of total churn)
* **Service Attitude:** 301 customers (17% of churn)
* **Dissatisfaction:** 300 customers (17% of churn)
* **Pricing Concerns:** 196 customers (11% of churn)
* **Other Factors:** 174 customers (10% of churn)

**Detailed Churn Reasons:**

Specific customer feedback reveals actionable issues:

* "Competitor made better offer"
* "Competitor had better devices"
* "Competitor offered higher download speeds"
* "Competitor offered more data"
* "Attitude of service provider"
* "Attitude of support person"

**7. Predictive Analytics Results**

**Machine Learning Model Performance:**

* **Algorithm:** Random Forest Classification
* **Accuracy:** 84% prediction success rate
* **Training Data:** Historical customer behavior patterns
* **Validation:** Rigorous testing on unseen data

**Prediction Results for New Customers:**

**High-Risk Customer Identification:**

* **Total Predicted Churners:** 378 out of 411 new joiners
* **Risk Rate:** 92% of new customers identified as high-risk
* **Immediate Action Required:** Proactive retention campaigns needed

**Predicted Churner Profile Analysis:**

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**Gender Distribution:**

* **Female:** 246 predicted churners (65.1%)
* **Male:** 132 predicted churners (34.9%)

**Age Group Concentration:**

* **>50 Years:** 126 high-risk customers
* **36-50 Years:** 128 high-risk customers
* **20-35 Years:** 112 high-risk customers
* **<20 Years:** 12 high-risk customers

**Contract Risk Distribution:**

* **Month-to-Month:** 355 customers (94% of predicted churners)
* **One Year:** 17 customers
* **Two Year:** 6 customers

**Payment Method Analysis:**

* **Credit Card:** 192 customers
* **Bank Withdrawal:** 150 customers
* **Mailed Check:** 36 customers

**Geographic Distribution of Risk:** Top states with predicted churners:

* **Uttar Pradesh:** 44 high-risk customers
* **Maharashtra:** 40 high-risk customers
* **Tamil Nadu:** 37 high-risk customers
* **Karnataka:** 29 high-risk customers
* **Andhra Pradesh:** 24 high-risk customers

**High-Value Customer Risk Table:**

The prediction model identified specific customers requiring immediate attention, including those with:

* High referral activity (up to 15 referrals)
* Varying revenue profiles ($24-$290 total revenue)
* Different charge structures (including promotional rates)
* Geographic concentration in key states

**8. Business Recommendations**

**Immediate Action Items:**

**1. High-Priority Retention Campaigns**

* Target 378 predicted churners with personalized offers
* Focus on female customers >50 with month-to-month contracts
* Implement geographic-specific strategies for Jammu & Kashmir and Assam

**2. Service Enhancement Initiatives**

* Bundle online security and device protection at competitive rates
* Address fiber optic service quality issues causing 41.1% churn
* Improve customer service training to address attitude-related churn (301 cases)

**3. Contract Optimization Strategy**

* Incentivize longer-term contracts with value-added benefits
* Offer contract conversion bonuses for month-to-month customers
* Create payment method migration incentives toward credit cards

**Strategic Long-term Initiatives:**

**4. Competitive Response Program**

* Monitor competitor offerings and develop counter-strategies
* Enhance device upgrade programs and promotional offers
* Implement price-match or value-enhancement programs

**5. Proactive Analytics Implementation**

* Deploy monthly customer risk scoring using the prediction model
* Integrate predictions with CRM systems for automated outreach
* Establish feedback loops to continuously improve model accuracy

**6. Geographic Market Strategies**

* Develop region-specific retention programs for high-churn states
* Investigate local competitive pressures in Jammu & Kashmir
* Consider service quality improvements in identified hotspots

**Expected Business Impact:**

* **Churn Reduction:** 15-20% decrease through targeted interventions
* **Revenue Protection:** Retain high-value customers identified through prediction
* **Cost Efficiency:** Focus retention spending on highest-risk segments
* **ROI Improvement:** Proactive retention vs. reactive customer acquisition

**9. Project Impact**

**Technical Capabilities Demonstrated:**

* **Data Engineering:** Complete ETL pipeline development and management
* **Business Intelligence:** Advanced dashboard design and interactive visualization
* **Machine Learning:** Predictive model development and validation
* **Business Analysis:** Strategic insight generation and recommendation development

**Business Value Delivered:**

* **Actionable Intelligence:** Clear identification of 378 high-risk customers requiring immediate attention
* **Strategic Insights:** Quantified impact of service gaps, demographics, and competitive pressures
* **Decision Support Tools:** Interactive dashboards enabling real-time business monitoring
* **Predictive Capabilities:** Proactive customer retention through advanced analytics
* **Cost Optimization:** Focused retention investment on highest-probability churn scenarios

**Stakeholder Benefits:**

* **Executive Leadership:** Clear KPIs and strategic direction for customer retention
* **Marketing Teams:** Specific customer segments for targeted campaigns
* **Customer Service:** Identified service gaps requiring immediate attention
* **Sales Teams:** Contract optimization opportunities and competitive insights
* **Operations:** Geographic priorities for service improvement initiatives

**10. Conclusion**

This comprehensive customer churn analysis project successfully transformed raw business data into strategic insights and actionable recommendations. The solution demonstrates the power of combining advanced analytics, machine learning, and business intelligence to address critical business challenges.

**Project Success Metrics:**

* **Complete Analysis:** 6,418 customer records analyzed with 27.0% churn rate identified
* **Predictive Accuracy:** 84% success rate in identifying future churners
* **Business Impact:** 378 high-risk customers identified for immediate retention action
* **Strategic Value:** Specific recommendations with 15-20% potential churn reduction

**Key Achievements:**

* Developed end-to-end data analytics solution from raw data to business recommendations
* Created interactive dashboards enabling ongoing business monitoring and decision-making
* Implemented machine learning model providing proactive customer risk identification
* Delivered specific, quantified recommendations for customer retention improvement

**Skills Demonstrated:**

* Advanced data analysis and pattern recognition
* Business intelligence dashboard development
* Machine learning model implementation and validation
* Strategic business recommendation development
* End-to-end project management and delivery

This project showcases my ability to work with complex business data, extract meaningful insights, and deliver solutions that directly support business objectives of customer retention and revenue protection. The comprehensive approach demonstrates readiness for senior analyst and data scientist roles requiring both technical expertise and business acumen.