**Data Science ML Development Plan**

**Mobile Phone Price Predictive Analytics Use Case**

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**Version 1.0**

**Use Case Project:** Mobile Phone Price Elasticity & Revenue Prediction

**Jr. Business Analyst:** Sounak Dutta Chowdhury

**Data Table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sr. No** | **Data Source Details:** | **Granularity:** | **Load Type:** | **Historical Data Range:** |
| 1. | mobile phone\_price\_dataset | Item Code Level (Based on Location Sub Type & Date) | Batch | 2024-05-01 to 2024-10-31, 6 months of data |

**Problem Statement**

Whenever there is a need to determine the price of the refurbished phones there should be replacement of the defective parts. Those parts should be available in inventory to quickly make those phones reuseable again and timely delivery in the market. Without accurately predicting the impact of price adjustments, the company risks either underpricing and losing potential revenue or overpricing and driving away customers, leading to unsold inventory. These gaps should be identified by the planners to better manage the inventory plan.

**Objective:**

* Identify the most defective parts among the list of the phone parts.
* Find out the most effective resalable price range.
* Understand the defective parts’ reusability. If not, the potential impact on refurbished mobile phones prices.
* Identify the retail distribution channels where most of these patterns occur.

All these enable dynamic pricing strategies for refurbished mobile phones that maximize revenue. This model will predict the impact of price changes on sales quantity and, consequently, on total revenue.

**Metric Table:**

|  |  |  |
| --- | --- | --- |
| **Metric Category** | **Column Combinations** | **Explanation** |
| **Time-based Trends** | Date, Region, Sales Area | Analyze how refurbished phones prices fluctuate over time across different regions and markets. |
| **Supplier Impact** | Suppliers, Item Code, Unit Price | Understand how different suppliers contribute to pricing variation for specific phone parts. |
| **Location Analysis** | Location, Region, Sales Area, Unit Price | Investigate how location and market factors impact refurbished mobile phone prices in various regions. |
| **Inventory Type** | Inventory Category, Item, Sub Inventory Code, Availability Code, Unit Price | Examine the influence of inventory types and item categories on refurbished mobile phone pricing. |
| **Item Trends** | Item Code, Item Description, Unit Price | Track specific phone parts and their price variations to identify pricing trends for refurbished mobile phones. |
| **Supplier Comparison** | Suppliers, Location Code, Item Code, Unit Price | Compare pricing strategies between different suppliers based on item and location. |

**Steps for Predictive Analytics:**

1. **Data Preparation & Segmentation:**
2. Segment the data by item code and availability to understand the presence of the phone parts in the inventory and then analyze price sensitivity for different markets and product types.
3. Clean the data to ensure accurate matching of "Item," "Unit Price," and "Qty" over time, ensuring there are no data entry errors or missing values.
4. **Price Elasticity Calculation:**
5. Use historical data on unit price and quantity sold to calculate the price elasticity of demand for each refurbished mobile phone.

Price elasticity: Ed =%change in price / %change in quantity demanded.

1. **Revenue Prediction Model:**
2. Build a predictive model to forecast total revenue based on changes in unit price of the refurbished mobile phones, segmented by product category, region, and supplier.
3. **Dynamic Pricing Recommendations:**
4. Use the model to suggest dynamic pricing strategies that adjust prices of the refurbished mobile phones based on predicted customer demand in different regions.
5. Ensure recommendations maximize total revenue without adversely impacting sales volume.

**Business Impact:**

Incorrect pricing strategies can lead to stockouts or excessive inventory, both of which harm the company. If prices are set too high, customers may refrain from purchasing, leading to stock accumulation. If prices are too low, demand might surge, causing stockouts. Both scenarios affect revenue and customer satisfaction. Proper analysis of price elasticity is essential to forecast revenue and adjust prices strategically.

**Key Tabs:**

|  |  |
| --- | --- |
| Problem Types | Classification/Regression/Time Series Analysis/Optimization |
| Missing Values in the Dataset | No |
| Outliers in the Dataset | (Yes/No) |
| Duplicate Variables in the Dataset | No |
| Train – Test Split approach | 70-30/80-20 |

**Methodologies for Handling Missing Values:**

Here some of these below methodologies are used to handle missing values.

* Delete records with NULLs.
* Imputation with Mean/Median (for Continuous Variables like Price or Sales)
* Forward or Backward Filling (for Time Series Data)
* Imputation Based on Similar Products (K-Nearest Neighbors - KNN)
* Dropping Rows with Missing Data (if non-critical)

**Methodologies for Handling Outliers:**

* Z-Score or Standard Deviation Method
* Clustering-Based Outlier Removal
* Quantile-Based Capping and Flooring
* Isolation Forest for Outlier Detection

**Feature Dictionary:**

|  |  |
| --- | --- |
| **Name** | **Description** |
| **Demand Fluctuation Index** | Measures the variation in phone parts demand in response to price changes on a monthly basis. |
| |  | | --- | | **Time Since Last Price Change** | | Number of days since the last price adjustment. Useful for analyzing how long a price has been stable before influencing demand. |
| **Stock out Time Range** | Number of consecutive days when a phone Part remains stocked out |
| |  | | --- | | **Inventory Holding Cost** | | Calculated based on the cost of storing unsold inventory over time, computed as Unit Price \* Days Held in Inventory. Helps optimize pricing strategies to avoid excess inventory. |
| **Stockout Range Group** | Group the Phone Parts as per their non availability over days. |

**ML Algorithm Selection:**

* Linear Regression
* Elastic Net Regression
* Random Forest Regression
* XGBoost
* ARIMA/Prophet

**Data & ML Pipeline:**

