

# Milestone 2

( Advanced Data Analysis, Visualization, and Features Engineering )

## 1- Data Analysis Report :

### 1) What is percentage of customers left the bank ?

- 20.4% of customers have left the bank.

### 2) How does Age affect customer churn ?

- Older and middle-aged customers tend to leave the bank more frequently.

#### - Solution :

- ✓ Introduce loyalty programs with financial benefits and better loan rates.
- ✓ Provide personalized financial advisory services.
- ✓ Simplify digital banking services for easier use.

### 4) How does Credit\_Score impact customer churn?

- Customers with poor, fair, and good Credit\_Scores leave the bank more than others.

#### - Solution :

- ✓ Offer free credit score improvement tips.
- ✓ Reward high credit score customers with exclusive benefits and lower interest rates.

### 6) Does bank Balance and Estimated Salary affect customer churn?

- Yes, customers with high balances and high estimated salaries tend to leave more.

#### - Solution :

- ✓ Provide VIP banking services with personalized financial advice and premium features.
- ✓ Offer high-yield savings accounts and attractive investment opportunities.
- ✓ Implement loyalty programs with special privileges for high-net-worth clients.
- ✓ Reduce fees or offer exclusive credit card benefits.
- ✓ Organize elite networking events and investment seminars.

### 8) How does the Number of products a customer has impact churn?

- Customers with only one banking product are more likely to leave.

#### - Solution :

- ✓ Encourage customers to open multiple accounts, such as insurance or investment products.
- ✓ Offer fee discounts for customers who subscribe to multiple banking products.

### 10) Does Credit\_Card ownership impact customer churn?

- There is no significant impact, but optimizing Credit\_Card benefits can improve retention.

#### - Solution :

- ✓ Provide cashback rewards or loyalty points.
- ✓ Promote credit card usage through exclusive purchase discounts and limited-time offers.

### 12) How does customer activity level impact churn?

- Inactive customers are more likely to leave the bank.

#### - Solution :

- ✓ Send regular notifications and promotional offers.
- ✓ Offer discounts or loyalty points to encourage frequent banking service usage.

### 14) Does geographic location affect customer churn?

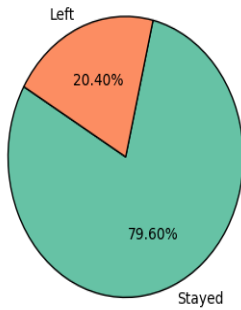
- Yes, France and Germany have higher churn rates compared to other regions.

#### - Solution :

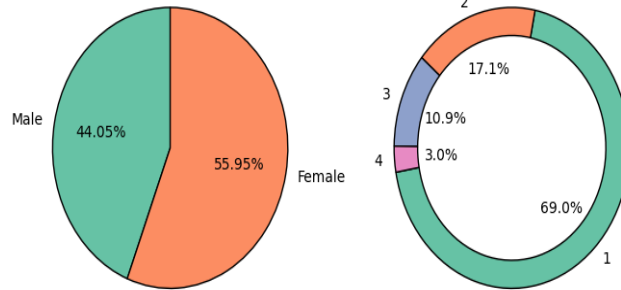
- ✓ Enhance customer service by providing multilingual agents and culturally relevant banking services.
- ✓ Offer region-specific promotions, such as fee discounts and higher savings interest rates.
- ✓ Improve local marketing campaigns to strengthen brand loyalty.
- ✓ Develop personalized retention strategies, including exclusive advisory services and tailored product offerings.
- ✓ Provide localized offers that meet the specific needs of customers in each country.

## 2- Data Enhanced Visualizations :

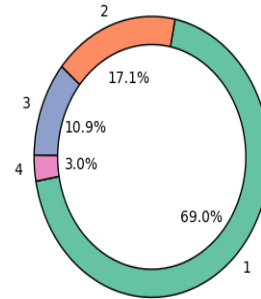
Clients Who Left and Stayed in the Bank



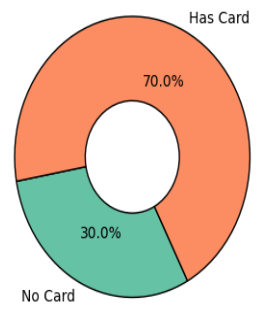
Gender Distribution Clients Who Left



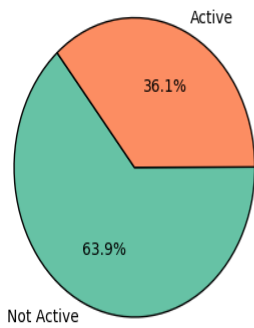
Number of Products Clients Who Left



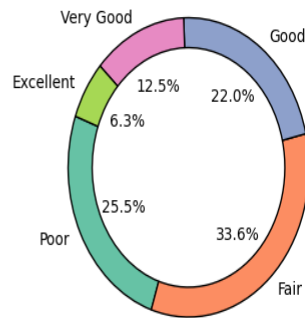
Credit Card Ownership Clients Who Left



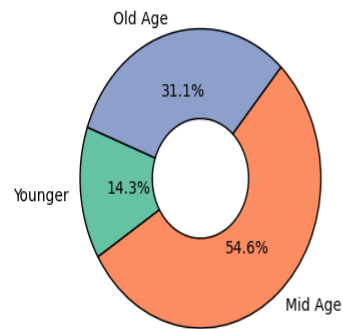
Active Membership Clients Who Left



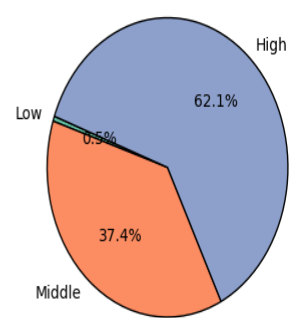
Credit Score Clients Who Left



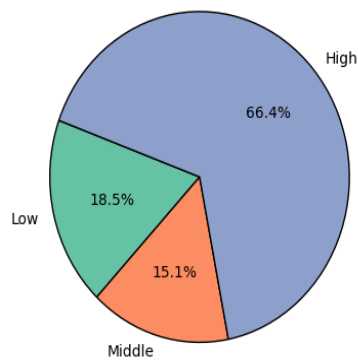
Age Range Clients Who Left



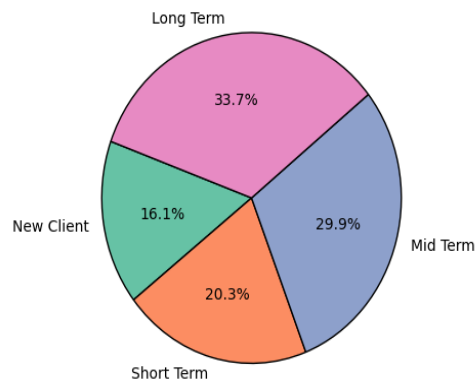
Balance Range Clients Who Left



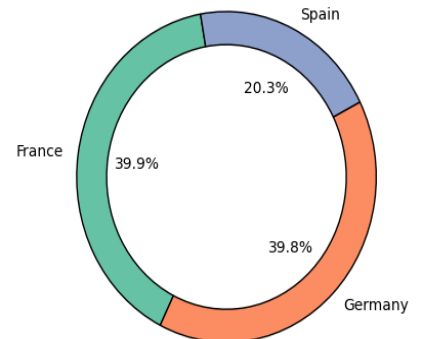
Estimated Salary Range Clients Who Left



Tenure Range Clients Who Left



Geography Clients Who Left



### 3- Feature Engineering :

#### 1- Features Creation :

##### 1. Credit\_score\_range :

- ✓ Categorized into (0: Poor, 1: Fair, 2: Good, 3: Very Good, 4: Excellent).

##### 2. Age\_rate :

- ✓ Categorized into (0: Young, 1: Middle-aged, 2: Old).

##### 3. Balance\_range :

- ✓ Categorized into (0: Low, 1: Middle, 2: High).

##### 4. Estimated\_salary\_range :

- ✓ Categorized into (0: Low, 1: Middle, 2: High).

##### 5. Tenure\_range :

- ✓ Categorized into (0: New, 1: Short, 2: Middle, 3: Long Tenure).

#### 2- Features Processing :

##### 1. Casting Features :

- ✓ Converted age, hasrcard, and isactivemember from float to integer.

##### 2. Encoding Features :

- ✓ Gender: Encoded as (0: Male, 1: Female).
- ✓ Geography: One-hot encoded.

##### 3. Scaling Features :

- ✓ Standardized Estimated\_salary and Balance using standard deviation.

##### 4. Oversampling with SMOTE :

- ✓ Applied SMOTE to balance the dataset and improve model training.