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# Step 1: Import Libraries
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.metrics import mean_squared_error, r2_score

# Step 2: Load Data
df = pd.read_csv("customer_survey_data.csv")  # Update with your filename

# Step 3: Initial Data Check
print(df.head())
print(df.info())
print(df.describe())

# Step 4: Handle Missing Values
df.fillna(df.mean(numeric_only=True), inplace=True)
df.dropna(inplace=True)  # Drop if essential fields still have NA

# Step 5: Encode Categorical Variables
label_encoders = {}
for col in df.select_dtypes(include='object').columns:
    le = LabelEncoder()
    df[col] = le.fit_transform(df[col])
    label_encoders[col] = le

# Step 6: Correlation Matrix
plt.figure(figsize=(12,8))
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sns.heatmap(df.corr(), annot=True, cmap="coolwarm")
plt.title("Correlation Heatmap")
plt.show()

# Step 7: Define Features and Target
target = 'Customer_Satisfaction'  # Replace with actual column name
X = df.drop(columns=[target])
y = df[target]

# Step 8: Train-Test Split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Step 9: Model Training
model = RandomForestRegressor(n_estimators=100, random_state=42)
model.fit(X_train, y_train)

# Step 10: Predictions and Evaluation
y_pred = model.predict(X_test)
print("R² Score:", r2_score(y_test, y_pred))
print("RMSE:", np.sqrt(mean_squared_error(y_test, y_pred)))

# Step 11: Feature Importance
importances = model.feature_importances_
feature_importance_df = pd.DataFrame({'Feature': X.columns, 'Importance': importances})
feature_importance_df.sort_values(by='Importance', ascending=False, inplace=True)

# Step 12: Plot Feature Importance
plt.figure(figsize=(10,6))
sns.barplot(x='Importance', y='Feature', data=feature_importance_df)
plt.title("Key Drivers of Customer Satisfaction")
plt.show()
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# Step 13: Top Insights
print("\nTop Drivers of Customer Satisfaction:")
print(feature_importance_df.head())
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