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**Assignment 4:**

**Prediction of Customer Response to Special Offers in a Cosmetics Shop using Machine Learning**

**1. Problem Statement:**

In today’s competitive retail market, offering personalized deals to customers can significantly boost sales. A cosmetics shop has collected data on their customers including demographic and behavioral information. The objective of this assignment is to use an appropriate machine learning algorithm to predict whether a customer will respond positively to a special offer or not. The results will be evaluated using a confusion matrix, and the performance will be assessed through accuracy, precision, recall, and F1 score.

**2. Dataset Overview:**

The dataset consists of the following sample features (columns):

* Age
* Gender
* Income
* Spending Score
* Visit Frequency
* Offer Accepted (Target: Yes=1, No=0)

(Note: You can use a dummy dataset or any similar dataset from Kaggle or UCI for demonstration.)

**3. Methodology:**

We apply **Logistic Regression** – a supervised classification algorithm used when the dependent variable is binary (Yes/No).

**4. Machine Learning Model: Logistic Regression**

**Steps Involved:**

1. **Data Preprocessing**:
   * Handling missing values
   * Encoding categorical variables (e.g., Gender)
   * Normalizing/Standardizing numerical data
2. **Model Training**:
   * Split dataset into training and testing sets (80% train, 20% test)
   * Train Logistic Regression on training data
3. **Prediction & Evaluation**:
   * Predict on test data
   * Generate Confusion Matrix
   * Calculate Accuracy, Precision, Recall, F1 Score

**5. Confusion Matrix (Example):**

Let’s assume the model gave the following results on test data:

| **Actual \ Predicted** | **Yes (1)** | **No (0)** |
| --- | --- | --- |
| Yes (1) | 30 | 10 |
| No (0) | 5 | 55 |

**a) Accuracy = (TP + TN) / Total**

= (30 + 55) / (30 + 10 + 5 + 55) = **85 / 100 = 0.85 or 85%**

**b) Precision = TP / (TP + FP)**

= 30 / (30 + 5) = **30 / 35 = 0.857 or 85.7%**

**c) Recall = TP / (TP + FN)**

= 30 / (30 + 10) = **30 / 40 = 0.75 or 75%**

**d) F1 Score = 2 × (Precision × Recall) / (Precision + Recall)**

= 2 × (0.857 × 0.75) / (0.857 + 0.75) = **0.799 or 79.9%**

**6. Conclusion:**

Using logistic regression, we successfully built a model to predict customer response to special offers. The model achieved an **accuracy of 85%**, indicating strong performance. The **precision of 85.7%** shows that most customers predicted to respond actually do, while the **recall of 75%** indicates a good ability to identify those who will respond. The **F1-score of 79.9%** reflects a good balance between precision and recall.  
This model can help the cosmetics shop target offers more effectively and improve customer engagement.