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| Case Study 1: E-Commerce Product Recommendation System |  |
| data science |

**Problem Statement**

How can an e-commerce platform recommend relevant products to customers based on their browsing history, purchase history, and preferences?

Dataset

**Source:** Public E-Commerce Dataset (Kaggle, UCI repository, or other sources)

**Columns:**

• User ID

• Product ID

• Product Category

• Purchase History (number of purchases)

• Rating (1–5)

• Timestamp of interactions

• Product Metadata (price, brand, description, etc.)

Data Science Process

1. Business Understanding

* **Goal:** Increase sales and improve user satisfaction by providing personalized product recommendations.
* **Business Value**: Personalized recommendations encourage customers to buy more items, increase engagement, and improve customer loyalty.

1. Data Understanding

* Collect data from browsing history, purchase transactions, and product metadata.
* Explore missing values, duplicates, and trends
* Identify relationships between products, categories, and users.

1. Data Preparation

* Handle missing values and duplicates.
* Convert categorical data (like product categories, brands) into numerical features using encoding.
* Normalize price and rating data.
* Create user-product interaction matrices.

1. Modeling

* **Approach 1: Collaborative Filtering**

Based on user-user similarity or item-item similarity.

* **Approach 2: Content-Based Filtering**

Use product metadata (category, brand, price) to recommend similar items.

* **Approach 3: Hybrid Model**

Combine collaborative and content-based methods for better accuracy.

1. Evaluation

* Split data set into training and testing sets.
* **Evaluate using metrics**
* **Precision@k**
* **Recall@k**
* **F1- Score**
* **RMSE**
* Perform cross-validation to improve robustness.

1. Deployment

* Integrate the recommendation system into the e-commerce platform.
* Continuously retrain the model with new user interactions.
* Monitor performance and update recommendations in real-time.