Machine Learning

RECOMMENDER SYSTEM

Case-Study on College Recommendation

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WHAT IS RECOMMENDER SYSTEM ?

In machine learning (ML), recommender systems are algorithms or models designed to suggest items, products, or content to users based on certain data or preferences. These systems are widely used in applications like e-commerce websites (e.g., Amazon), streaming platforms (e.g., Netflix, Spotify), social media (e.g., Facebook, Instagram), and many others, where users are presented with suggestions tailored to their tastes, past behavior, or preferences.

Recommender systems aim to increase user engagement, satisfaction, and retention by presenting relevant suggestions and helping users discover new content or products they may not have found otherwise.

As per our case-study, The aim of the recommender system is to assist students in finding colleges that match their academic achievements, thereby enhancing their likelihood of being accepted into a program that suits their abilities.

IN-DEPTH ABOUT CASE-STUDY

Creating a recommender system for college recommendations based on factors like Intermediate marks, JEE, NEET, and EAMCET scores can be an excellent project to showcase your skills in machine learning, data analysis, and recommendation algorithms. This system could suggest suitable colleges to students based on their academic performance in various entrance exams.

Collect Data:

You'll need to gather data about colleges, including:

- College Name
- Location
- Programs Offered (Engineering, Medical, etc.)
- Cut-off Scores for various courses (e.g., JEE Main/Advanced rank, NEET score, EAMCET rank)
- Admission Trends (historical data on how students with similar scores were admitted)
- Fees
- Infrastructure and Facilities (optional)

IN-DEPTH ABOUT CASE-STUDY

Preprocess and Clean the Data:

Before building the model, you'll need to clean and preprocess the data:

- Handle missing values (e.g., if some data points are missing for a college)
- Normalize/standardize scores to ensure consistency (e.g., JEE score normalization)
- Categorize colleges based on different factors (course types, regions, etc.)

You could also convert categorical variables (like college type, region) into numerical representations using techniques like one-hot encoding.

Build the Recommender System:

Depending on the approach you want to take, you can build a content-based or collaborative filtering recommender system

TYPES OF RECOMMEDER SYSTEMS

COLLABORATIVE FILTERING:

Collaborative filtering provides recommendations by analyzing user preferences and patterns found in historical data. In our case-study, a "user" might refer to a student, while an "item" could represent a college. There are two main types of collaborative filtering: User-based and Item-based.

User-Based Collaborative Filtering:

In user-based collaborative filtering, the idea is to recommend colleges to a student based on what similar students (i.e., students with similar academic profiles) have liked or chosen.

Challenges:

- *Cold Start Problem*: This approach struggles with new students, particularly when there is minimal historical data available for a student or when a college lacks previous application data from students.
- *Scalability*: As the student population grows, the similarity matrix expands significantly, leading to increased computational costs for the system.

TYPES OF RECOMMEDER SYSTEMS

1. COLLABORATIVE FILTERING:

Collaborative filtering provides recommendations by analyzing user preferences and patterns found in historical data. In our case-study, a "user" might refer to a student, while an "item" could represent a college. There are two main types of collaborative filtering: User-based and Item-based.

Item-Based Collaborative Filtering:

item-based collaborative filtering, the system suggests items (colleges) that are similar to those the student has expressed interest in, instead of looking for similar students.

Challenges:

- *Sparsity*: If students apply to many different colleges, the dataset of applications can become sparse, which makes it challenging to identify meaningful relationships between the colleges.

TYPES OF RECOMMEDER SYSTEMS

2. CONTENT-BASED FILTERING:

Content-based filtering recommends items (colleges) based on their attributes and a user's preferences, rather than on the preferences of other users.

Advantages:

- Works well even if the student is new (i.e., no historical data or behavior).
- Recommendations are made based on objective factors (like exam scores and college cutoffs), which can be easily explained to the user.

Challenges:

- Limited Diversity: Since the recommendations are purely based on the student's profile, the system might recommend very similar colleges, which could reduce diversity in the recommendations.
- Need for Detailed Metadata: The system requires detailed information about each college's cutoffs, programs offered, and other attributes, which may not always be available.

TYPES OF RECOMMEDER SYSTEMS

3. HYBRID RECOMMENDER SYSTEM:

A hybrid approach would combine both content-based and collaborative filtering techniques. For instance, the system could first filter out colleges based on a student's academic profile, and then refine those recommendations using collaborative filtering based on the choices of students with similar scores.

Advantages:

- More Accurate Recommendations: Combining both methods results in a more balanced approach, where recommendations are tailored to both the student's specific academic profile and the preferences of similar users.
- Better Handling of Sparsity: Hybrid models can handle cold-start problems (new users, new colleges) better by combining different sources of information.

Challenges:

- Complexity: Hybrid models are more complex to implement and tune. Combining multiple techniques requires careful integration of the models and fine-tuning to achieve optimal performance.

EXAMPLE OF WORKFLOW OF CASE-STUDY

Let’s see an example for a student:
Student 1:
Intermediate Marks: 88%
JEE Rank: 4000
NEET Rank: 8000
EAMCET Rank: 1500

College:
College A:
JEE: 3500
NEET: 10000
EAMCET: 2000
Program: Engineering (JEE)

EXAMPLE OF WORKFLOW OF CASE-STUDY

College B:
JEE: 5000
NEET: 12000
EAMCET: 2500
Program: Engineering (JEE)

College C:
JEE: 4500
NEET: 8000
EAMCET: 1800
Program: Medical (NEET)

Step-by-Step Process:
Preprocessing: Normalize the scores to a common scale and handle missing data (e.g., if a college does not have EAMCET data, use JEE/NEET data).

EXAMPLE OF WORKFLOW OF CASE-STUDY

Calculate Similarity: Use a similarity measure (e.g., cosine similarity) to calculate how well Student 1's scores match each college's cutoff scores.

Rank Colleges: Based on similarity scores, rank the colleges. For example:

College A: JEE Cutoff = 3500 → Very close to Student 1's JEE Rank (4000), so it gets a high ranking.
College B: JEE Cutoff = 5000 → Far from Student 1's JEE Rank, so it gets a lower ranking.

College C: NEET Cutoff = 8000 → Close to Student 1's NEET Rank (8000), so it also gets a good

CONCLUSION OF **CASE-STUDY TOPIC**

Recommender systems have revolutionized personalized decision-making across various fields, and in education, they offer unique value by guiding students toward academic institutions that align with their strengths and goals. By leveraging data from academic scores, exams, and personal preferences, a college recommendation system simplifies the complex college selection process, helping students make well-informed choices.

This approach reduces decision fatigue, increases the likelihood of academic fit, and broadens access to suitable colleges. While challenges like data privacy and the cold start problem exist, hybrid models and secure data handling can address these issues, ensuring accurate, personalized recommendations. As technology continues to evolve, these systems have the potential to become essential tools in empowering students to reach their academic potential, paving the way for more accessible, data-driven educational guidance.

THANK YOU

A Presentation By

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