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BACHELOR OF SCIENCE IN COMPUTER SCIENCE

Project Report:

Recommender System Using Collaborative Filtering

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Introduction

In today's digital world, personalization is essential to enhance user experience. Recommender systems play a crucial role in sectors such as e-commerce, media streaming, online advertising, and social networking by tailoring content suggestions to individual preferences. This project focuses on developing a recommender system using collaborative filtering recommendation technique to generate precise recommendations based on user behavior. By combining thorough research, efficient data processing, and iterative model refinement, the system not only contributes valuable insights into personalized recommendation technologies but also has extensive real-world applications. For example, in e-commerce, it can drive personalized shopping experiences by suggesting products that align with customer preferences, while in media streaming, it can curate tailored viewing lists to enhance engagement. Additionally, industries like online advertising and social networking can leverage the technology to improve targeting strategies and content relevance. This integration of academic research and practical innovation demonstrates the versatility and potential impact of the system across multiple sectors.

1. Objectives

The primary objectives of this project are:

- **Personalized Recommendations:** Develop a system that accurately predicts user interests by analyzing patterns in user behavior.
- **Performance Evaluation:** Measure the system's performance using appropriate metrics such as Root Mean Squared Error (RMSE), precision, recall, and F1-score.
- **Scalability and Efficiency:** Design the system to efficiently handle large datasets and provide real-time recommendations.
- **User-Centric Approach:** Ensure the recommendations enhance user satisfaction and engagement through iterative testing and feedback incorporation.

2. Methodology

a. Literature Review:

Examine current research on both user-based and item-based collaborative filtering to understand their benefits and drawbacks.

b. Data Handling:

Source and prepare datasets (e.g., MovieLens for films or relevant e-commerce data), clean the data by managing missing values, normalizing ratings, and splitting it for training and testing.

c. Model Development:

- **User-Based:** Find similarities among users using historical interaction data.

- **Item-Based:** Calculate item similarities to recommend options similar to those previously liked.
 - Evaluate both approaches to select the optimal method.
- d. **Algorithm Implementation:**
Apply similarity measures (like cosine similarity or Pearson correlation) to refine the recommendation process through iterative adjustments.
- e. **Evaluation and Iteration:**
Validate the system with standard performance metrics, fine-tune parameters, address cold-start issues, and integrate user feedback.
- f. **Documentation:**
Record all methodological choices, encountered challenges, iterative modifications, and the final performance analysis.

3. Tools and Technologies

- **Programming:** Python, chosen for its extensive libraries supporting data manipulation and machine learning.
- **Libraries:**
 - *NumPy & Pandas* for data handling,
 - *Scikit-Learn* for model implementation,
 - *Surprise, TensorFlow, or PyTorch* (depending on how the implementation is going I might need it) for advanced modeling.
- **Database:** SQL systems such as PostgreSQL to efficiently manage and query large datasets.
- **Resources:** Online datasets (e.g., MovieLens), academic publications for theoretical insights (I am still researching on open data sources to be used for simulation), and GitHub for version control and collaboration (with you, my supervisor).

4. Expected Results

- **Prototype:** A working system providing personalized recommendations based on user behavior.
- **Performance Analysis:** Quantitative results showing system accuracy and efficiency.
- **Comprehensive Report:** Detailed documentation of the methodology, experimental findings, challenges, and suggestions for future enhancements.
- **Future Directions:** Recommendations to further improve system performance, scalability, and address emerging challenges in personalized recommendation systems.