Book Recommendation System — Overview

- Three recommenders: Association Rules (FP-Growth), Item-based Collaborative, Content-based (TF-IDF)
- Hybrid endpoint combines outputs and provides explanations
- Flask UI with AJAX, visualization panels: top rules, clusters, evaluation

Data & Inputs

- books.csv: book_id, title, author, description, genres
- ratings.csv: user_id, book_id, rating (used by collaborative filtering)
- transactions.csv: transaction_id, items (used by association rule mining)

Association Rules (FP-Growth)

- Convert transactions to one-hot matrix with TransactionEncoder (mlxtend)
- Run fpgrowth to get frequent itemsets (support)
- Generate rules with association_rules (confidence, lift)
- Use rules to suggest consequents given antecedents (market-basket)

Item-based Collaborative Filtering

- Build user-item matrix from ratings (users x books)
- Compute item-item similarity using cosine similarity on item vectors
- Score unknown items for a user with weighted sum of similarity*rating
- Provide explanations: top contributing items that influenced score

Content-based (TF-IDF)

- TF-IDF vectorizer on book descriptions (stop words removed)
- Cosine similarity between TF-IDF vectors to find most similar books
- Useful for cold-start items with descriptive metadata

Comparison & When to Use Which

- Association: good for bundle/cross-sell when transaction data abundant
- Collaborative: personalized, needs sufficient user ratings; susceptible to cold-start
- Content: works with item metadata; good for new items but not personalized
- Hybrid: combines strengths — use ensemble or weighted combination

Evaluation Metrics

- Precision@k, Recall@k, MAP, NDCG — use time-aware split for realism
- Quick demo uses a random train/test split and precision@5 (demo only)

Demo Flow & Talking Points

- Start UI -> demonstrate Association Rules, Collaborative, Content-based, Hybrid
- Show top rules panel, clusters, and evaluation metric
- Explain mapping to syllabus units (Unit V => FP-Growth, Unit IV => clustering, Unit VI => visualization)