

Multi-Modal Recommendation System

1. Dataset

We use the MovieLens 100K dataset, which contains 100,000 user-item interactions and metadata on movie genres. This serves as the basis for collaborative and content-based filtering.

2. Methodology

We implemented three hybrid recommendation models:

Autoencoder-Based Model (PyTorch):

- Learns latent features through deep neural network.
- Combined with genre similarity for hybrid scoring.

LightFM-Based Model:

- Matrix factorization with user/item metadata support.
- Efficient and interpretable hybrid mechanism.

Surprise + Genre Merge:

- Combines classical SVD collaborative filtering with genre-based similarity scores.
- Simpler hybrid baseline, useful for benchmarking.

3. Cold-Start Strategy

For cold-start users and items:

- Recommend top-N popular items based on frequency.
- For new items, rely on genre-based similarity.

4. Evaluation

Each model was evaluated using:

- Precision@10
- NDCG@10

These were computed on a test set split from MovieLens 100K.

Multi-Modal Recommendation System

5. Scalability Considerations

- Approximate nearest-neighbor search using FAISS/Annoy for content similarity.
- Store user/item embeddings in Redis for real-time access.
- Deploy models via microservices for modular, scalable architecture.
- Use Spark or PyTorch distributed training for collaborative models.

6. Conclusion

This project demonstrates three scalable hybrid recommendation strategies integrating collaborative filtering and content-based techniques. Each model offers unique trade-offs in performance, complexity, and interpretability. These systems are capable of handling real-world scenarios including cold-start challenges.