MovieLens

Introduction to Deep Learning

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CONTENT

01 Project Background & Objectives

Background:

- MovieLens dataset with **implicit feedback only** (watch history, no ratings)
- Highly sparse user–item matrix (~97% empty)
- Key question: under such extreme sparsity, can we still make effective recommendations?

Objectives:

- Compare **deep sequential models** (MLP, CNN, GRU)
- Evaluate **popularity bias** in recommendations
- Explore **debiasing strategies** to improve diversity & personalization

02 Methodology & Workflow

Data Preparation

- Chronological split: Train 80%, Val 10%, Test 10%
- User sequences (SEQ_LEN=10)
- Negative sampling (1:4 ratio)
- Config-driven for reproducibility

Deep Learning Models

- Baselines: Popularity, Personal Top-K, ItemKNN, MF
- Deep models: **MLP, CNN, GRU**
- Debiasing: popularity penalty (α)

Evaluation Metrics

- **Accuracy:** Recall@K, HitRatio, MRR
- **Beyond-accuracy:** Coverage, Diversity
- Protocol: Sampled ranking (1 pos + 99 negs)

Interpretation & Insights

- Compare deep vs. baseline performance
- Accuracy–diversity trade-off
- Business-level implications for personalization

03-08 Instructions

Sections 03–08 are shown directly in the Jupyter Notebook:

03
Splits & Samples

Data overview, train/val/test split, sequence construction, negative sampling

04
Baselines (EDA)

Popularity, Personal Top-K, ItemKNN, MF performance

05
Deep Models

MLP, CNN, GRU results and comparisons

06
Training & Evaluation

Learning rates, sampled ranking protocol, metrics (Recall@K, HR, MRR)

07
Ablations & Debiasing

SEQ_LEN, NEG_RATIO, embedding size; popularity penalty α

08
Error Analysis & Conclusion

Popular vs long-tail distribution; final findings and implications

09 Final Takeaways

Key Findings

- GRU = best balance (recall + interpretability)
- Debiasing (α=0.1) ↑ coverage to 82% w/o loss
- Long-tail share 77.6% vs. 22.4% popular

Business Value

- Beyond popularity bias
- Broader personalization
- Long-tail boosts retention

Future Directions

- Balance accuracy, diversity, fairness

Deep learning improves accuracy while expanding long-tail coverage.