Language-Enhanced Session-Based Recommendation with Decoupled Contrastive Learning

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Hybrid Multimodal Architecture

The paper proposes a hybrid multimodal approach for sessio n-based recommendation, addressing challenges like popular bias and cold-start problems by combining textu-al content a nd item IDs using CatBoost.

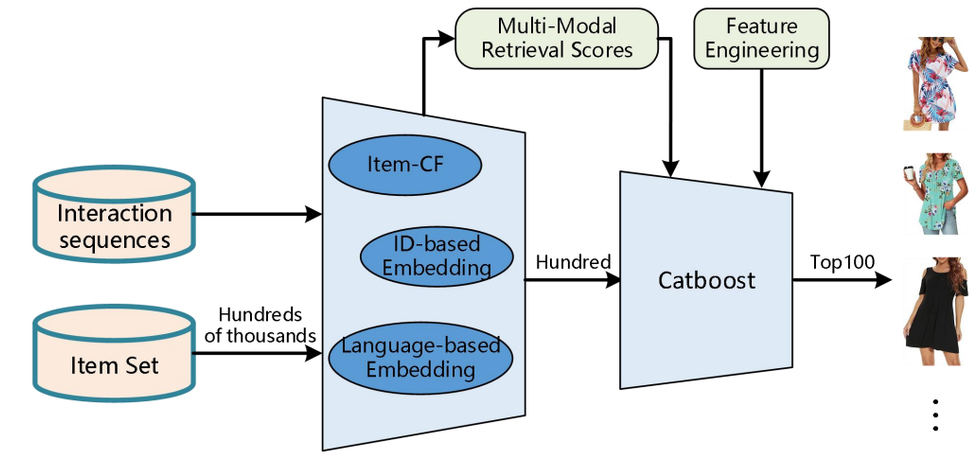

Figure 1: The Holistic Framework of the Proposed Hybrid Multimodal Approach.

ID-based Retrieve With GRU

To address vanishing gradients, we propose a sequence-level residual connection block. It applies mean pooling to the initi al fused embeddings before the GRU layer and adds it to the GRU output for the final sequential representation.

Important feature in the Rerank stage: Graph

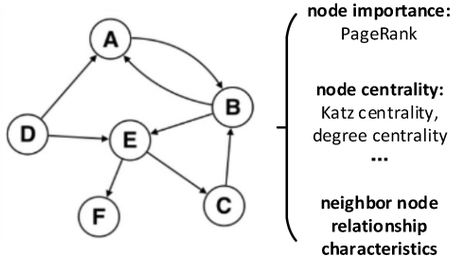

Figure 2: Co-occurrence graph of products.

This study constructs a co-occurre nce graph based on the co-occurre nce relationship matrix to extract graph topology features. These fea tures describe the importance and connectivity of candidate items wi thin the co-occurrence graph.

Key Finding : Decoupled Contrastive Learning

We propose Decoupled Contrastive Learning to improve item text representation. It divides the negative sample space into sequential and item subspaces, leveraging a dual-momentum queue for updating and storing many negative samples. Two cont-rastive learning losses are calculated, enabling bidirectional deep alignment betwe-en sequential and item representations.

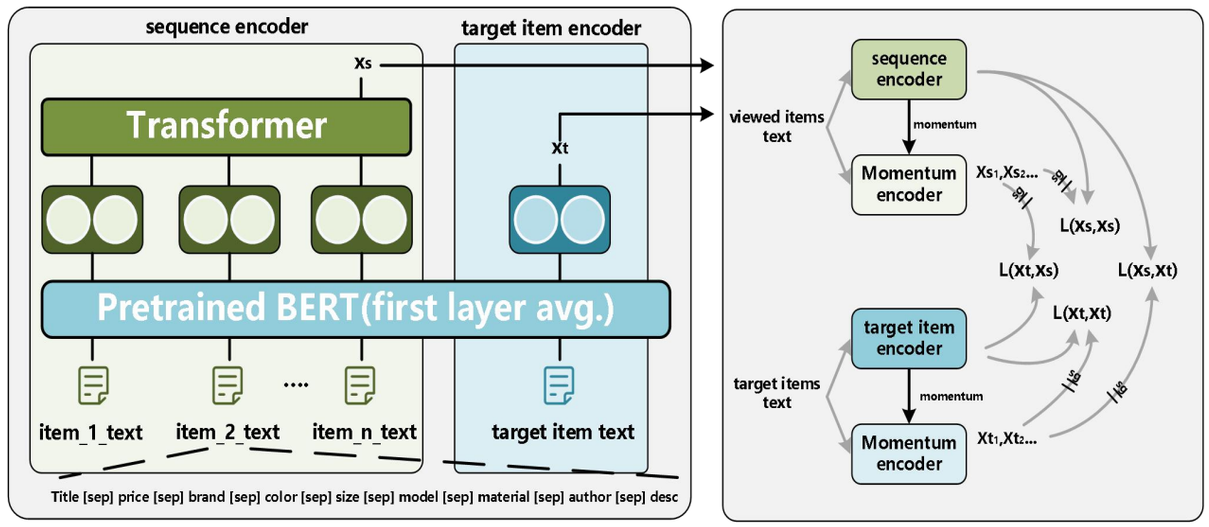

Figure 3: Visualization of Language Embedding Generation and Training Flow of Decoupled Contrastive Learning.

EXPERIMENTS

Dataset	Metric	Ranking
leaderboard	mrr@100=0.4033	5th
validation	mrr@100=0.3394	-

Table 1: Overall Performance of our approach.

Variants	CV-MRR@100
w/o Decoupled Contrastive Learning	0.2610
λ_1:λ_2:λ_3:λ_4=0.5:0.5:0:0	0.2687
λ_1:λ_2:λ_3:λ_4=0.25:0.25:0.25:0.25	0.2676
λ_1:λ_2:λ_3:λ_4=0.45:0.3:0.125:0.125	0.2718
Language Emb	**0.2725**

Table 2: The influence of Decoupled Contrastive Learning.

Variants	CV-MRR@100	Leaderboard
GRU	0.3073	0.3792
ItemCF	0.2941	-
Language Emb	0.2725	-
Catboost Fusion	0.3175	-
++Feature Engineering	**0.3394**	**0.4034**

Table 3: Performance of the Multimodal Fusion Rerank.