[Enhancing LLM-Based Recommendation with Context-Aware Parameter Modulation via Hypernetworks]

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Research Motivations

LLMs show promise in recommendation systems but adapting them efficiently remains challenging.
Standard CoRA relies solely on static user-item CF embeddings, lacking dynamic adaptation to varying contexts.

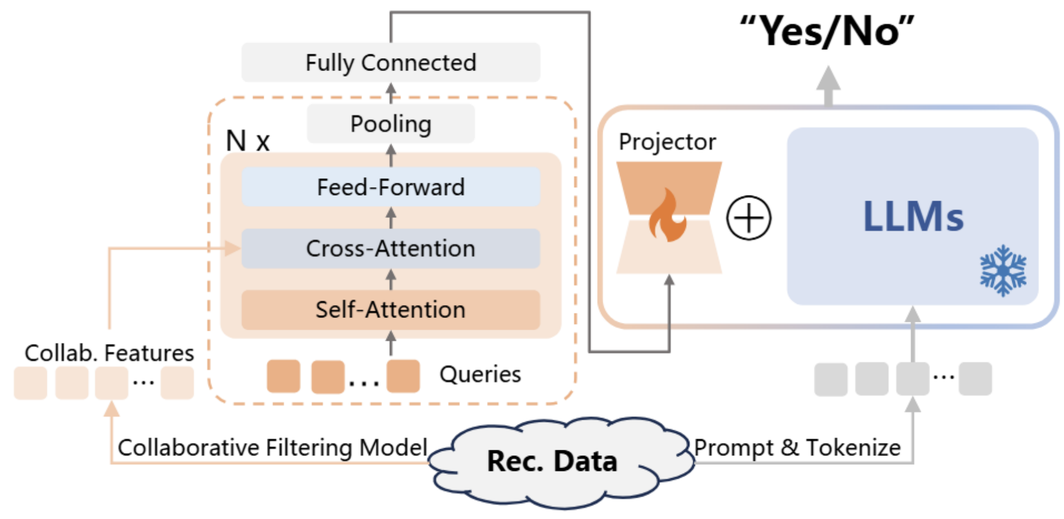
Context-aware adaptation is needed for cold-start users, popular item bias, session variations, or prediction uncertainty.

We proposed CA-CoRA using hypernetworks to dynamically generate LoRA weights based on context.

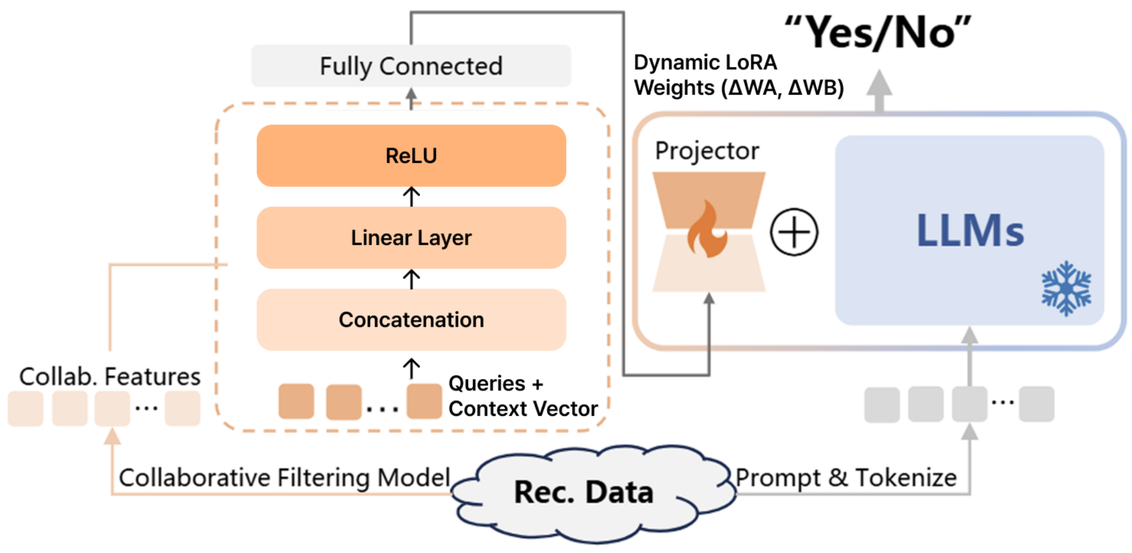
Background

CoRA Framework

- Aligns collaborative filtering embeddings with LLM parameters using Low-Rank Adaptation, enabling recommendations without prompt engineering .
- Uses pre-trained CF models such as MF, LightGCN, and SASRec, to generate user-item embeddings.



Hyperntеworks & LoRA



Replaced CoRA's Attention-based Query Generator with an efficient Hypernetwork for dynamic weight generation

Ablation Study

Metric	AUC	UAUC
CoRA	0.7028	0.6714
CA-CoRA	0.6982	0.6934

- Dataset: ML-1M, compared against CoLLM-MF (CoRA)
- AUC Result: Overall AUC slightly decreases, suggesting a small trade-off
- UAUC Result: UAUC score improves, showing better personalized adaptation

Future Work

We plan to explore richer contextual signals (session history, temporal signals) and optimize the Hypernetwork architecture to minimize the AUC trade-off. Future studies will also include a comprehensive comparison against existing CoRA variants (SASRec, LGCN) on diverse, larger datasets.