Large Language Models
for Recommendation Systems

De la Factorización de Matrices a la IA Generativa

Universidad de La Laguna

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Pablo Hernández

Programando todo tipo de cosas desde 2010

Mi stack

Actualmente estudiando en ULL

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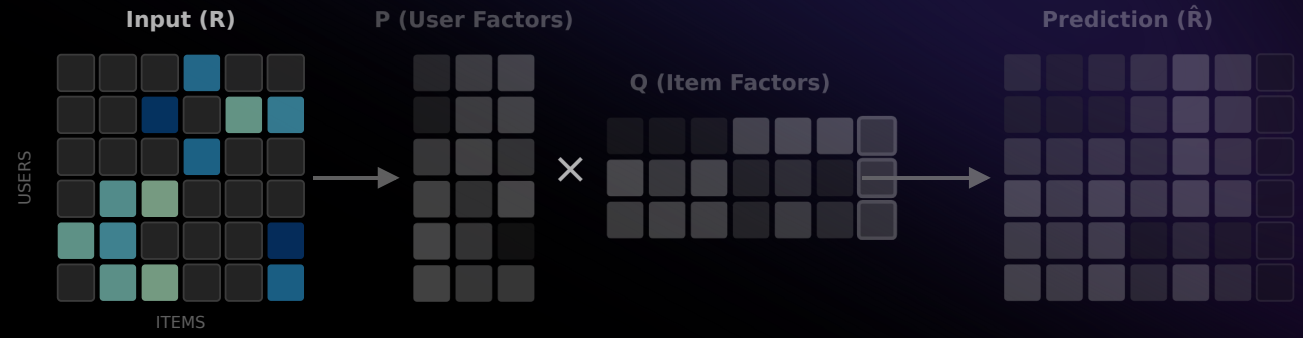
RecSys Clásico

Tiene límites claros

Cold Start & Falta de Semántica



MODEL OUTDATED: RETRAINING...

Entran los LLMs

Semántica

Entienden el contenido y el contexto, no solo coinciden IDs o etiquetas.

Zero-Shot Rec

Capacidad de recomendar sin historial previo del usuario (Cold Start).

Conversacional

El usuario puede pedir mejoras o cambios en lenguaje natural.

Explicabilidad

El modelo puede razonar y explicar por qué recomienda algo específico.

RAG & Knowledge

Uso de conocimiento externo y bases de datos vectoriales para enriquecer los datos.

Transfer Learning

Conocimiento general del mundo aplicado a tu dominio específico.

Arquitecturas

Discriminative

Embeddings

Usar el LLM (ej. BERT) para generar representaciones vectoriales densas de items y usuarios para calcular similitud.

Generative

SeqRec

Fine-tuning o Prompting (ej. GPT) para predecir el "siguiente token" como el "siguiente item" a consumir.

PROMPT TEMPLATE

```
User History: [Matrix, Inception, Interstellar]
Task: Recommend next movie.
Reasoning: User likes sci-fi & mind-bending plots.
Recommendation: _
```

THE STACK

FINE-TUNING PIPELINE

- **Unsloth** — Fast Training
- **TRL** — SFT / DPO
- **PEFT** — LoRA / QLoRA
- **Qwen 2.5** — Base Model

RETRIEVAL STACK

- **Sentence Transformers** — BERT / E5
- **Vector DB**
- **LangChain** — Orchestrator

Implementation Strate

Data: MovieLens 1M

Sliding Window Strategy: Transformamos el historial de interacciones en una conversación.

`[A, B, C] → D` `[B, C, D] → E`

Engine: Qwen 2.5 + Unsloth

Utilizamos **Unsloth** para optimizar el fine-tuning (2x más rápido, -70% VRAM) sobre una **A100** en Google Colab.

Open Notebook
Full Training & Inference Pipeline

jupyter nbviewer

JUPYTER FAQ

Open in Colab

In […

```
import os
import torch

# 1. Nuke Environment
!pip uninstall -y torch torchvision torchaudio flash-attn xformers unsloth trl pe

# 2. Install PyTorch 2.8.0 + CUDA 12.6
# We grab this from the pytorch release/test index if not yet in main,
# but assuming standard availability based on your logs.
!pip install torch==2.8.0 torchvision==0.23.0 torchaudio==2.8.0 --index-url https

# 3. Install Flash Attention 2.8.3 (Wheel for Torch 2.8)
!pip install https://github.com/Dao-AILab/flash-attention/releases/download/v2.8.

# 4. Install Xformers 0.0.32.post2 (Matches Torch 2.8)
# We force this version so Unsloth doesn't backtrack.
!pip install xformers==0.0.32.post2 --index-url https://download.pytorch.org/whl/

# 5. Install Unsloth with the PyTorch 2.8 specific tag
# [cu126onlytorch280] tells Unsloth to expect Torch 2.8 and Xformers 0.0.32.post2
!pip install "unsloth[colab-new,cu126onlytorch280] @ git+https://github.com/unslo

# 6. Install TRL & Utils
!pip install --no-deps trl peft accelerate bitsandbytes scikit-learn pandas

print("□ Environment Locked: Torch 2.8.0 | FA 2.8.3 | Unsloth [cu126onlytorch280]"
```

```
Found existing installation: torch 2.9.0+cu126
Uninstalling torch-2.9.0+cu126:
  Successfully uninstalled torch-2.9.0+cu126
Found existing installation: torchvision 0.24.0+cu126
Uninstalling torchvision-0.24.0+cu126:
  Successfully uninstalled torchvision-0.24.0+cu126
Found existing installation: torchaudio 2.9.0+cu126
Uninstalling torchaudio-2.9.0+cu126:
  Successfully uninstalled torchaudio-2.9.0+cu126
WARNING: Skipping flash-attn as it is not installed.
WARNING: Skipping xformers as it is not installed.
WARNING: Skipping unsloth as it is not installed.
WARNING: Skipping trl as it is not installed.
Found existing installation: peft 0.18.0
Uninstalling peft-0.18.0:
  Successfully uninstalled peft-0.18.0
Looking in indexes: https://download.pytorch.org/whl/cu126
Collecting torch==2.8.0
  Downloading https://download.pytorch.org/whl/cu126/torch-2.8.0%2Bcu126-cp312-cp
312-manylinux_2_28_x86_64.whl.metadata (30 kB)
```

Muchas gracias

Diapositivas y referencias en: hadronomy.com