Exercise#2: Hands-on Practice of a Hyper-Relational KGRL Method

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Key Facets in Modern Knowledge Graph Representation Learning (KeyKGRL), ISWC 2025 Tutorial

https://bdi-lab.kaist.ac.kr

KAIST BDILab
BIG DATA INTELLIGENCE

01 Overview

- We run an hyper-relational KGRL method, **MAYPL**, on Google Colab.
  - We use WikiPeople- and WD20K(100)v2 in this exercise
    - WikiPeople- is an HKG dataset for transductive link prediction
    - WD20K(100)v2 is an HKG dataset for inductive link prediction

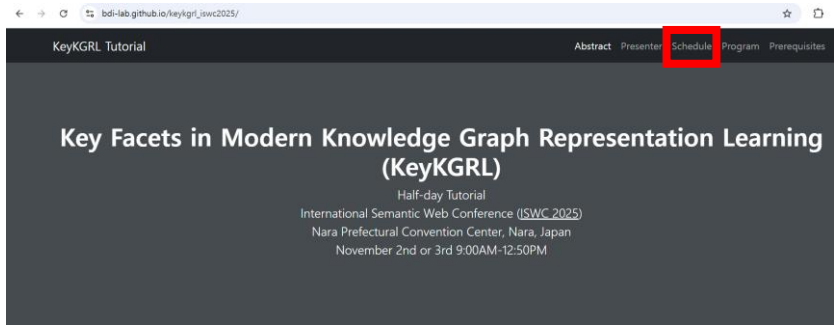
- Part #1: **Top 3 similar entities/relations to a target in WikiPeople-**
  - Top 3 similar entities to the entity “Vancouver”
  - Top 3 similar entities to the entity “computer scientist”
  - Top3 similar relations to the relation “family”

- Part #2: **MAYPL’s top 3 predictions on problems in WikiPeople-**
  - Top 3 predictions for the problem ((Marilyn Monroe, born in, Los Angeles), {(country, USA), (is located in, ?)})
  - Comparing top 3 predictions for the problems with an identical triplet but with different qualifiers

- Part #3: **Reproducing the results of MAYPL on WD20K(100)v2**

02 Accessing the Exercise Material

- Method #1: Use the homepage of our Tutorial
  - 1. Access https://bdi-lab.github.io/keykgrl_iswc2025/
  - 2. Click “Schedule” at the right side of the bar on the top
  - 3. Click “[Exercise2]Hands-on Practice of Inductive KGRL” in the table

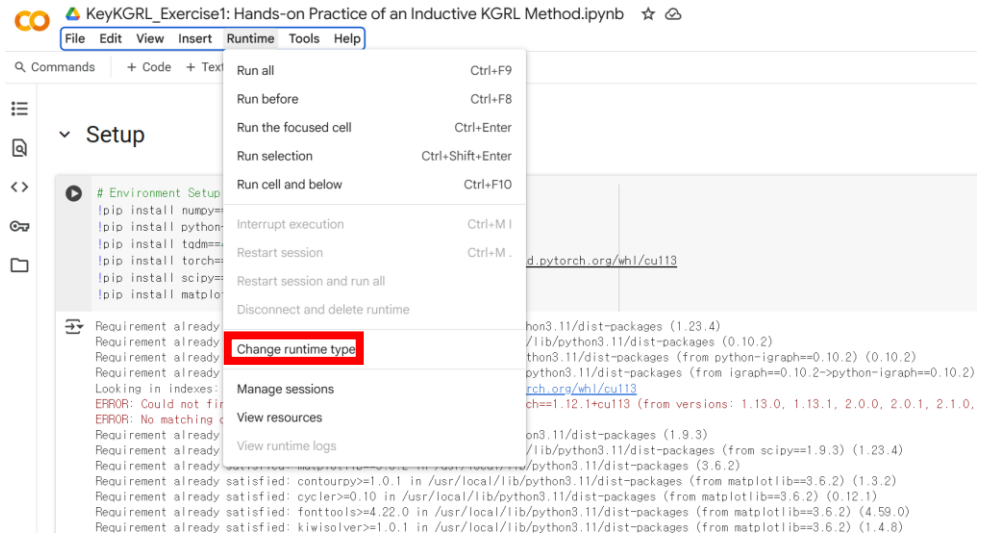


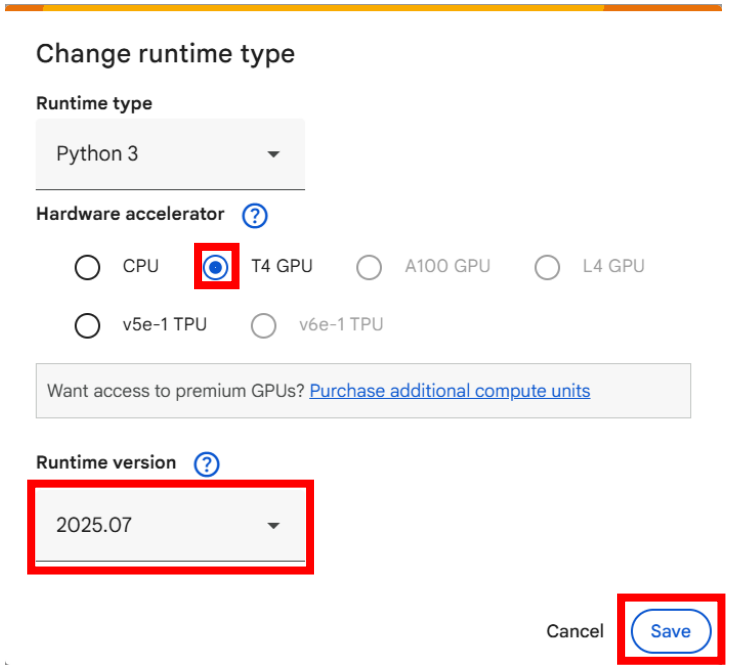
Time Slot	Tutorial Time	Program
9:00 - 9:40	9:00-9:10	Opening & Introduction to Knowledge Graphs
	9:10-9:45	[Lecture 1] KG Embedding with Multimodal Data
	9:45-10:20	[Lecture 2] Inductive Reasoning on KGs
	10:20-10:40	[Exercise 1] Hands-on Practice of Inductive KGRL
10:40-11:10	Break Time	
11:10-12:50	11:10-11:45	[Lecture 3] KG Foundation Models
	11:45-12:20	[Lecture 4] Representation Learning on HKGs
	12:20-12:40	[Exercise 2] Hands-on Practice of HKGRL
	12:40-12:50	Discussion & Closing

- Method #2: Direct Link
  - https://colab.research.google.com/drive/1Xp-a8CnNDmrSy0fQmqJ6DLzwsPpWAJHs?usp=sharing

02 Environment Setup

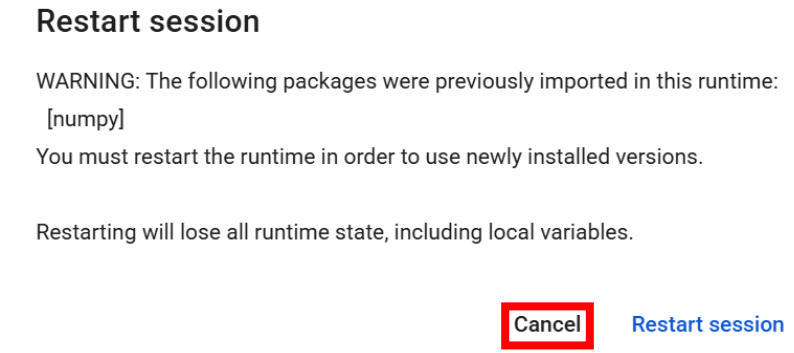
- We use a GPU in this exercise
  - Runtime -> Change runtime type -> click a GPU in hardware accelerator -> save
- We use previous runtime version
  - Runtime -> Change runtime type -> Runtime version -> 2025.07



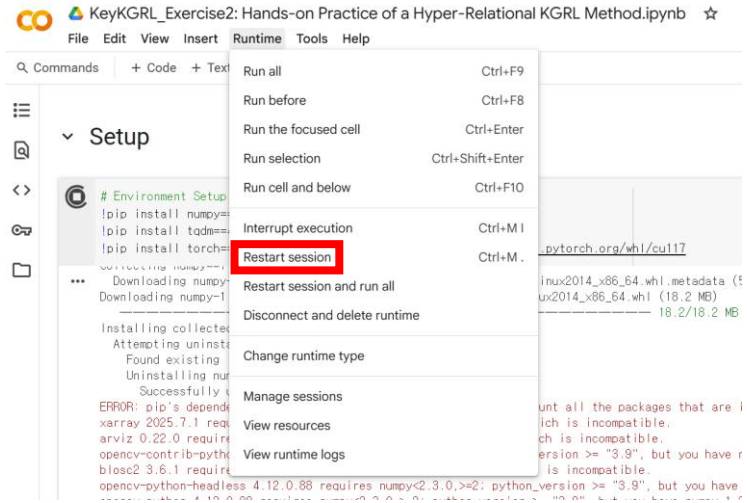


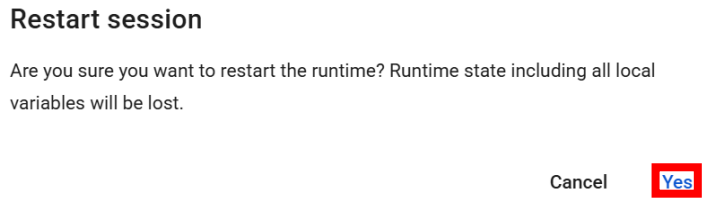
02 Environment Setup

- 1. Run the first cell, and wait until it finishes running
  - Ignore the warning and click “Cancel”



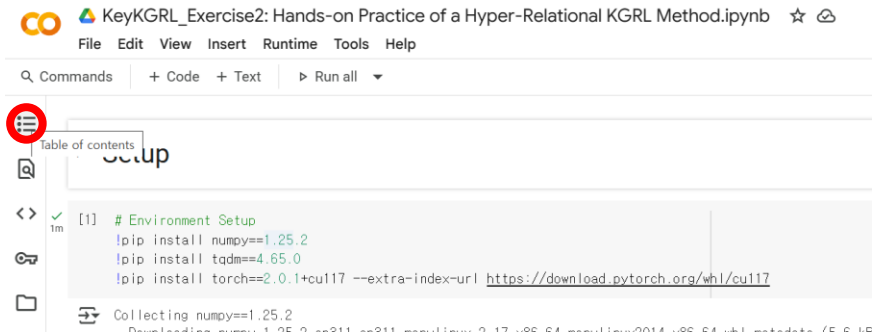
- 2. Restart the session after the cell is finished



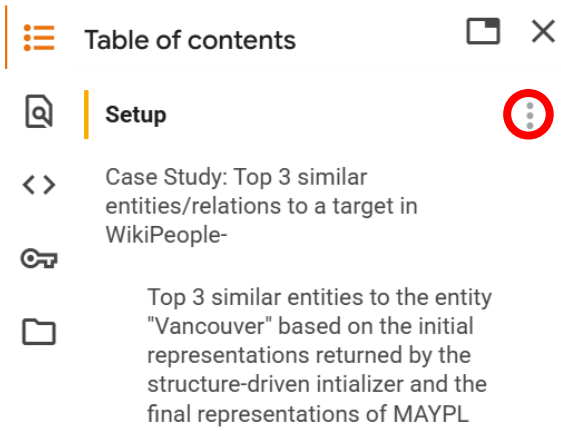


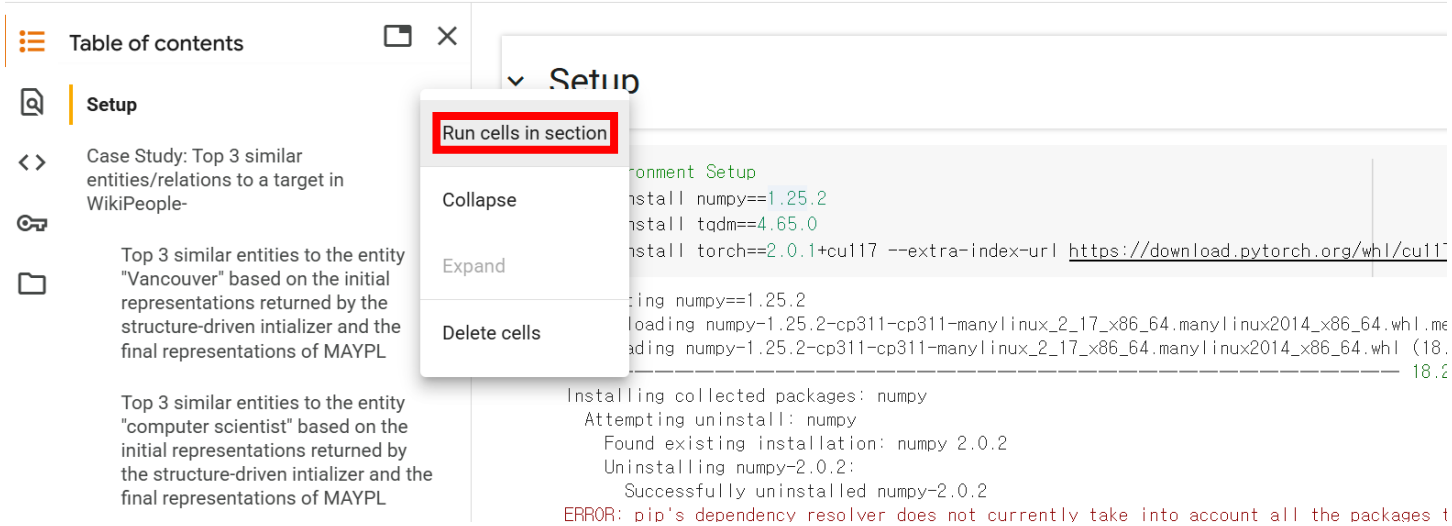
02 Environment Setup

- 3. Open the table of contents in the left side bar



- 4. Run all cells in the section “Setup”





03 Top 3 Similar Entities or Relations to a Target

- Compute the initial and final representations of the entities and relations

```
[ ]  ## Computes the intial and final representations of the entities and relations

     with torch.no_grad():
         emb_ent, emb_rel, _, _ = my_model_WPm(WPm.pri_inf.clone().detach(), WPm.qual_inf.clone().detach(), WPm.qual2fact_inf, ₩
                                               WPm.num_ent_inf, WPm.num_rel_inf, ₩
                                               WPm.hpair_inf.clone().detach(), WPm.hpair_freq_inf, WPm.fact2hpair_inf, ₩
                                               WPm.tpair_inf.clone().detach(), WPm.tpair_freq_inf, WPm.fact2tpair_inf, ₩
                                               WPm.qpair_inf.clone().detach(), WPm.qpair_freq_inf, WPm.qual2qpair_inf)


         init_ent = emb_ent[0]
         init_rel = emb_rel[0]
         final_ent = emb_ent[-1]
         final_rel = emb_rel[-1]
```

- We will inspect entity “Vancouver”, entity “computer scientist”, and relation “family”
  - We compute the top 3 most similar entities or relations based on the initial representations and the final representations of MAYPL

03 Top 3 Similar Entities or Relations to a Target

- Entity: Vancouver

```
========TOP 3 ENTITIES BASED ON INITIAL REPRESENTATIONS========
Venice
Budapest
Gothenburg
```

```
========TOP 3 ENTITIES BASED ON FINAL REPRESENTATIONS========
Toronto
Victoria
Ottawa
```

- Entity: computer scientist

```
========TOP 3 ENTITIES BASED ON INITIAL REPRESENTATIONS========
psychologist
professeur des universités
inventor
```

```
========TOP 3 ENTITIES BASED ON FINAL REPRESENTATIONS========
mathematician
programmer
artificial intelligence researcher
```

- Relation: family

```
========TOP 3 RELATIONS BASED ON INITIAL REPRESENTATIONS========
manner of death
country of citizenship
ethnic group
```

```
========TOP 3 RELATIONS BASED ON FINAL REPRESENTATIONS========
sibling
family name
father
```

03 MAYPL’s Top 3 Predictions

- MAYPL's predictions for the problem ((Marilyn Monroe, born in, Los Angeles), {(country, USA), (is located in, ?)})

```
=====TOP 3 Predictions=====
California
New York
New York City
```

- MAYPL’s Predictions for the Problems with an Identical Primary Triplet but with Different Qualifiers
  - Primary Triplet: ((?, awarded, Oscar for Best Director))
  - Qualifiers #1: {(subject of, 60th Oscars), (for work, The Last Emperor)}

```
=====TOP 3 Predictions for ((?, awarded, Oscar for Best Director), {(subject of, 60th Oscars), (for work, The Last Emperor)}) =====
Bernardo Bertolucci
Miloš Forman
David Byrne
```

  - Qualifiers #2: {(for work, A Beautiful Mind)}

```
=====TOP 3 Predictions for ((?, awarded, Oscar for Best Director), (for work, A Beautiful Mind)}) =====
Ron Howard
James Cameron
Steven Spielberg
```

03 Reproducing the Results of MAYPL

- We reproduce MRR, Hit@10, and Hit@1 values of MAYPL on the test set of WD20K(100)v2

	WD20K(100)v2		
	MRR	Hit10	Hit1
BLP	0.040	0.092	0.015
CompGCN	0.026	0.053	0.007
StarE	*0.051*	0.129	0.014
QBLP (w/o qual.)	0.049	0.097	*0.026*
QBLP (w/ qual.)	0.067	*0.120*	0.035
MAYPL	**0.298**	**0.518**	**0.195**

```
100%|██████████| 21/21 [00:04<00:00,  4.71it/s]
Link Prediction (Pri, 1356)
MRR:0.2975
Hit10:0.5184
Hit1:0.1947
```