

International Knowledge Graph Reasoning Challenge (IKGRC)

Application Sheet

1. Information about the applicants

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2. Explanation of the reasoning and estimation process

- Explain key points.

Most of the previous methods using machine learning for this challenge have generated a new knowledge graph from the original one, and some information is lost in the process of creating a new knowledge graph. Therefore, we proposed a new model to estimate the criminal without changing the original knowledge graph. In this case, it is necessary to deal with triples whose head is the non-existent scenes where the crime was committed. Therefore, we propose a model that makes this possible.

Figure 1 shows the proposed model. The model is trained to take the triple sequence with some entities and relations replaced by “<mask>” token as input, and to predict the hidden entities and relations. This training was inspired by BERT's Masked Language Modeling.

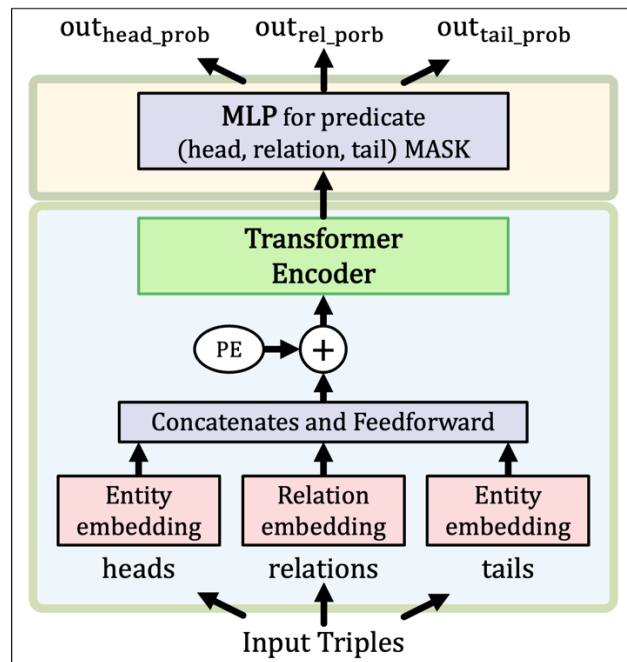


Figure 1. The Proposed Model

By using “<mask>” token, we can deal with non-existent scenes in which the criminal committed the crime.

When predicting the criminal, the model estimates the criminal by inputting a series of triples that connect the existing triples about the story and the non-exist triples about the crime scene. In this case, the criminal is “<mask>” token, so it can be predicted in the same way as in the training.

Figure 2 shows an example of input series. We consider the subject of the last non-existent scene to be the criminal and check the predicted results for its mask.

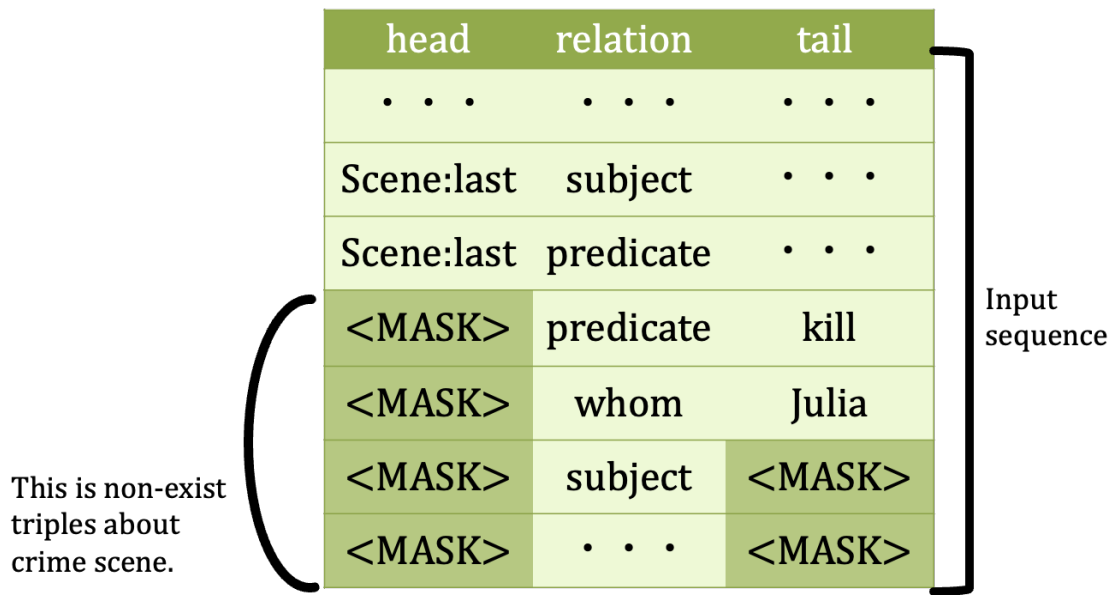


Figure 2. The example about input triple sequence.

Table 1 shows the ranking of the criminals' estimation for each title. When dealing with missing data, the model predictions were less accurate. Overall, the results were good.

Table 1. The estimated rank.

Title	0 %	-10 %	-25 %
The Speckld Band	1	1	2
The Devil's Foot	2	2	1
The Devil's Foot	1	1	32
The Abbey Grange	1	1	1
The Resident Patient	1, 2, 4	1,2,3	3,4,7
Silver Blaze	1	3	6

- Range of knowledge graphs used (Scene ID)

Basically, we used all scenes. When checking accuracy at the time of loss, only those parts were excluded.

- Description of external knowledge added for reasoning

No other knowledge is used in the proposed model.

- Performance information

CPU: Intel(R) Core(TM) i9-10900K CPU @ 3.70GHz

GPU: GeForce RTX 3090 (GPU Memory: 24GB)

Memory: 32GB

OS: Ubuntu22.04 (Use on Docker)

3. Developed application

- URL from which the executable application can be downloaded.

It was mainly implemented with the Python CLI. The URL of the repository is shared.

The “develop” branch is my development branch, so it is unstable, see the “main” branch.

-> URL: https://github.com/RyoyaKaneda-Student/knowledge_graph

- How to use

First, install Python, and install Poetry as it is used for managing dependencies. Then, install the dependent libraries before running the program.

The file for creating the model is “src/run_for_KGC.py”.

Please check the command “python src/run_for_KGC.py -h” for the required parameters.

The code to check the estimation of the criminal is “src/visualization/check_results.py”.

Change the path as necessary in this file.

Please refer to readme.md in the repository for the setup procedure using docker.

4. Sharing of materials

If possible, we would like to publish your “Application Sheet” and “Program” on the IKGRC website*. Please let us know by filling out the form below.

*We may use some of the submitted materials in events related to the IKGRC.

[Application Sheet]

- Public availability:

☐ Allow to publish

☐ Do not allow to publish

- Publication format

☐ Published on the IKGRC website

☐ Publish on your own site and wish to be linked to our site.

-> URL*:

[Submitted application, source code, data, etc.]

- Public availability:

☐ Allow to publish

☐ Do not allow to publish

- Publication format

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