HUHKA at the NTCIR-15 QA Lab-PoliInfo-2 Entity Linking Task

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1. Our methods

We use a combination of named entity recognition and named entity disambiguation methods to solve the Entity Linking task.

Entity Linking task

- Named entity recognition: We extract mentions of "law names" from local assembly member's utterances.
- Named entity disambiguation: We link the extracted mentions to Wikipedia title with knowledge bases i.e. Wikipedia and e-Gov[1].

[1] https://www.e-gov.go.jp

1.1. Named entity recognition methods

We extract mentions of "law name" with BERT, and filter the extracted mentions using filter 1 and filter 2.

BERT

We use BERT model, which is available at DeepPavlov[1].
The model is a multilingual named entity recognition model, which was pretrained from the multilingual BERT using Ontonotes.
We further fine tuned the model on the training data of QA Lab-PoliInfo-2 Entity Linking task datasets.

Filter 1

If the sentence input into BERT does not contain the word "法", it is filtered with filter 1 and all outputs are set to "O".

Filter 2

We extract the mentions that match following regular expressions. If the mention does not match the following phrases, the output is "O".

「.*[法|法律|法案|法制|法律案]¥$」

[1] V. Mozharova and N. Loukachevitch. Two-stage approach in russian named entity recognition. In 2016 International FRUCT Conference on Intelligence, Social Media and Web (ISMW FRUCT), pp. 1–6, Aug 2016.

1.2 Named entity disambiguation methods

We disambiguate the extracted mentions and link them to Wikipedia using exact match, Wikipedia2Vec, mention-entity prior, and e-Gov.

exact match

If the extracted mentions and the Wikipedia title corresponds to an exact match, the named entity disambiguation outputs the Wikipedia title.

Wikipedia2Vec[2]

We use Wikipedia2Vec to generate the output as the Wikipedia article title with the highest similarity to the extracted mentions.

mention-entity prior[3]

We select the top ranked entities based on the mention-entity prior $p(e|m)$, where e *is* a given entity and m *is* a mention.

e-Gov

We use the law search system provided by e-Gov. The system registers abbreviations of formal law names. We use these pairs of formal names and abbreviations as dictionary.

[2] IKuya Yamada, Akari Asai, Jin Sakuma, Hiroyuki Shindo, Hideaki Takeda,Yoshiyasu Takefuji, and Yuji Matsumoto. Wikipedia2vec: An efficient toolkit for learning and visualizing the embeddings of words and entities from wikipedia.arXiv preprint 1812.06280v3, 2020
[3] Octavian-Eugen Ganea and Thomas Hofmann. Deep joint entity disambiguationwith local neural attention. In Proceedings of the 2017 Conference on Empirical Methods in Natural Language Processing, pp. 2619–2629, Copenhagen, Denmark, September 2017. Association for Computational Linguistics.

2. Our results

NER methods	NED methods	Score
BERT + filter 1 + filter 2	mention-entity prior + e-Gov	0.6035
BERT + filter 1 + filter 2	mention-entity prior	0.5863
BERT + filter 1 + filter 2	e-Gov	0.5518
BERT + filter 1 + filter 2	Wikipedia2Vec + e-Gov	0.5130
BERT + filter 1 + filter 2	Wikipedia2Vec	0.5000
BERT + filter 1	mention-entity prior + e-Gov	0.4887
BERT + filter 1	mention-entity prior	0.4747
BERT + filter 1	e-Gov	0.4468
BERT + filter 1	Wikipedia2Vec	0.3980
BERT + filter 1	mention-entity prior + Wikipedia2Vec	0.3980
BERT + filter 1	exact match	0.3247

Scores in the formal run　Scores in the formal run（late submissions）

3. Discussion

・The combination methods of both the filter 1 and the filter 2 outperformed the results using only filter 1. This is probably because the wrong mention, like phrases which do not contain "法", was extracted during the mention extraction process. These results showed filter 2 is also useful to remove noise.

・Disambiguation using e-Gov alone produced lower results than using mention-entity prior. However, when e-Gov was combined with other disambiguation methods, their scores increased.

・Specifically, the combination of e-Gov and mention-entity prior showed the best results—a score of 0.6035.

→ Using dictionaries such as e-Gov to process mentions that could be reliably disambiguated, the results of the combination methods were better than those obtained by other methods when they were used alone.

4. Conclusion

・We achieved the best score out of all the team.

・The combination of e-Gov and mention-entity prior showed the best results—a score of 0.6035.

・ Using Filter 2 and using e-Gov are useful to improve the score in this task.

Example of filter 1

Input: 質疑 の ある 方 は 順次 御 発言 願い ます 。

The sentence does not contain "法", so all output is "O".

Output: O O O O O O O O O O O

Input: 一昨 年 の IR 推進 法 の 審議 の 際 に は 、 …

Input into BERT

BERT

Output of BERT

Output: O O O B I I O O O O O O O …

Example of filter 2

Input: 大手 カジノ 企業 が 、 カジノ 推進 法 の 提案 者 で ある …

BERT Output: O B I O B I I O O O O O …

Mention: カジノ企業　カジノ推進法

filter 2

Output: O O O O B I I O O O O O …

Example of Wikipedia2Vec

Input mention: カジノ法案

Input into Wikipedia2Vec

Wikipedia2Vec

Wikipedia2Vec output

Entity	Similarity
特定複合観光施設区域の整備の推進に関する法律	0.9999
特定複合観光施設区域整備推進本部	0.7917
建設工事従事者の安全及び健康の確保の推進に関する法律	0.7750
第191回国会	0.7680

Output entity: 特定複合観光施設区域の整備の推進に関する法律　The highest similarity entity to the mention

Example of mention-entity prior

Input mention: 独占禁止法（m）

Entity	$p(e\|m)$
独占禁止法（e_1）	0.6135
私的独占の禁止及び公正取引の確保に関する法（e_2）	0.3865

Output entity: 独占禁止法　top ranked entity

独占禁止法（m）

link to e_1 6,135 times

$$p(e_1 \mid m) = \frac{6{,}135}{6{,}135 + 3{,}865} = 0.6135$$

link to e_2 3,865 times

$$p(e_2 \mid m) = \frac{3{,}865}{6{,}135 + 3{,}865} = 0.3865$$