Neural Adversarial Training for Semi-supervised Japanese Predicate-argument Structure Analysis

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Introduction & Task

We propose a novel GAN-like model: generator and validator networks that enable the model to learn from an unlabeled corpus.

- Japanese predicate-argument structure (PAS) analysis is a task to find an argument for each case of a predicate.
- PAS analysis relies on the numerous pairs of predicates and their arguments depending on their contexts. However, annotated corpora for PAS analysis are very limited.
- Our validator scores the generator outputs and enables the generator to learn predicate and argument pairs from unlabeled corpora.

(1) タクシーが$_{\text{NOM}}$ 客を$_{\text{ACC}}$ 駅に$_{\text{DAT}}$ 送った 。
takushi-ga kyaku-wo eki-ni okutta .
A taxi carried passengers to the station.

(2) その 列車は 荷物を$_{\text{ACC}}$ 運んだ 。
sono ressha-wa nimotsu-wo hakonda.
The train also carried baggages.

(3) タクシーが$_{\text{NOM}}$ 客を$_{\text{ACC}}$ 乗せた とき 事故に$_{\text{DAT}}$ 巻き込まれた 。
takushi-ga kyaku-wo noseta toki jiko-ni makikomareta.
When the taxi picked up passengers, it was involved in the accident.

(4) この 列車に は 乗れません 。
kono ressha-ni-wa noremasen.
You can not take this train.

Predicate	NOM	ACC	DAT
送った okutta sent/carried	タクシー takushi taxi	客 kyaku passenger	駅 eki station
運んだ hakonda carried	列車 ressha train	荷物 nimotsu baggage	NULL
乗せた noseta picked up	タクシー takushi taxi	客 kyaku passenger	NULL
巻き込まれた makikomareta was involved	タクシー takushi taxi	NULL	事故 jiko accident
乗れません noremasen can not take	あなた anata you	NULL	列車 ressha train

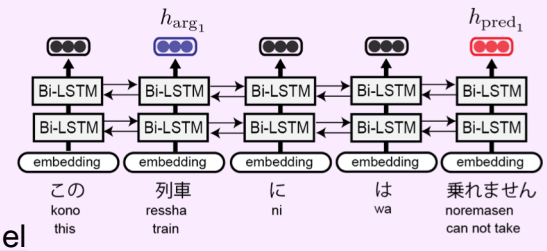
Examples of Japanese PAS analysis. For predicates in a sentence, the model predicts NOM, ACC and DAT case roles of arguments.

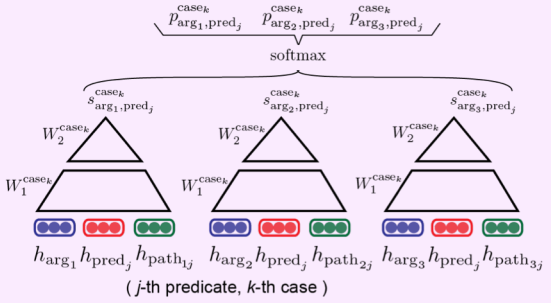
Model

Our entire model consists of the generator network that predicts the arguments for each predicate and the validator network that scores the outputs of the generator network.

Generator

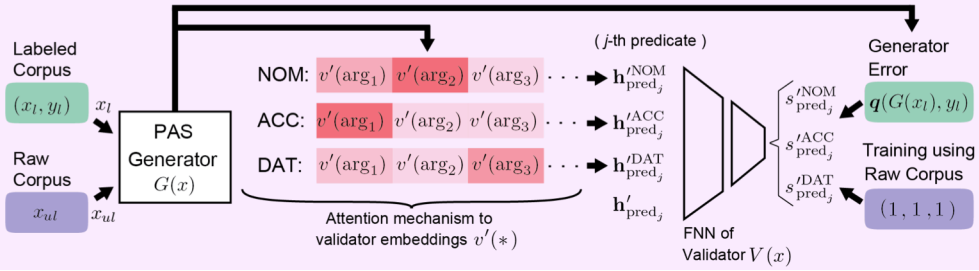
- The generator consists of two neural networks: the bi-LSTM based sentence encoder and the FNNs for argument selection.
- There are three FNNs for NOM ACC and DAT cases.





Validator & Overall Model

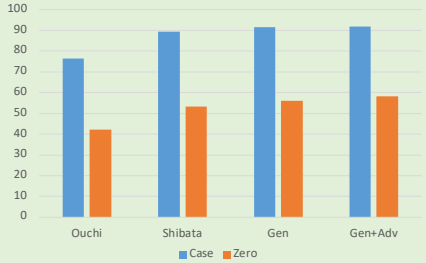
- We propose the validator network that has inputs from the generator network and outputs the validity of the generator outputs.
- The generator and the validator networks are coupled by the weighted sum of the validator embeddings (attention mechanism).
- We firstly train the generator by a supervised method. Then we train the validator and the generator using this validator



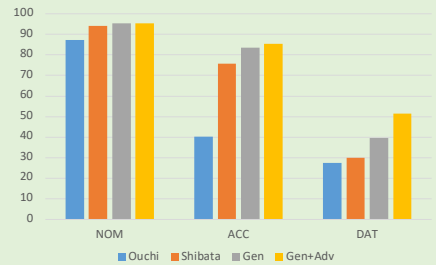
Experiments & Results

- We use the KWDLC dataset [Hangyo+ 12] for evaluations, following [Hangyo+ 13, Shibata+ 16].
- We evaluate our model in two tasks: case analysis and zero anaphora resolution.
- **Gen** is the generator network trained with the supervised learning method, while **Gen+Adv** is the proposal model trained with the validator, compared with [Ouchi+15, Shibata+ 16].
- We obverse large increases of scores in ACC and DAT cases. They have fewer training instances and relies on external knowledge resources of predicates and arguments.

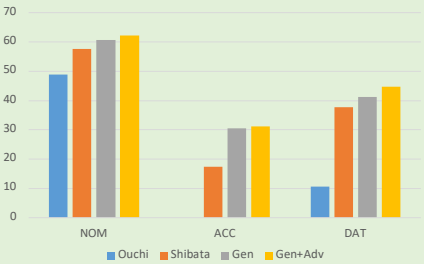
Case / Zero for all cases



Case Analysis



Zero Anaphora Resolution



Conclusion

- We propose novel adversarial training model for PAS analysis.
- Our validator enables the generator to learn from an unlabeled corpus as an external knowledge resource.
- We achieve SOTA scores in all cases of KWDLC.

References

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[5] M. Hangyo, D. Kawahara and S. Kurohashi. Building a diverse document leads corpus annotated with semantic relations (2012).