

論文 / 著書情報  
Article / Book Information

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著者(和文)	ZhangYing
Author(English)	Ying Zhang
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種別(和文)	論文要旨
Type(English)	Summary

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## 論文要旨

THESIS SUMMARY

系・コース :

Department of, Graduate major in

情報通信

系

コース

申請学位 (専攻分野) : 博士

Academic Degree Requested

Doctor of

(工学)

学生氏名 :

Student's Name

Zhang Ying

審査員主査 :

Chief Examiner

奥村学教授

要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

Natural language processing (NLP) involves tasks that enable computers to process and understand human languages, whether in text or speech, with the goal of improving communications between humans and machines, as well as among humans themselves. The origins of NLP can be traced back to the 1950s when Alan Turing introduced the Turing Test as a tool to determine whether a computer is as skillful as a human being in processing human languages. With the rapid development of the Internet and computer hardware in recent decades, the field of NLP has experienced significant growth, and many NLP applications are now widely used in our daily lives, such as Google Translate and Apple Siri. One notable advancement in recent years is the emergence of ChatGPT, a large-scale intelligent language model, that has gained global attention for its impressive conversational capabilities.

In NLP, discriminative models are often preferred over generative models owing to their direct computation and proven success in various applications such as machine translation, text summarization, and named entity recognition, despite challenges such as unbalanced data distribution and limited training data. However, recent studies have highlighted two significant issues that arise when using discriminative models: text degeneration and exposure bias, which can hurt the quality of the models' predictions.

The primary objective of this thesis is to improve the prediction results from discriminative models by presenting two re-ranking-based methods: the language model-based reranker (LMR) and the bidirectional Transformer reranker (BTR), to counter the decoding issues of text degeneration and exposure bias. The aim of this study is to propose general ideas that can be easily implemented in NLP tasks, including discourse parsing and grammatical error correction, without requiring complex modifications to the existing discriminative model structure or excessive computational resources.

The proposed LMR is designed as a generative model that leverages information from the top- $\alpha$  candidates generated by a discriminative model. In addition to the source text, the LMR also treats each candidate as the input. For each candidate, the LMR employs a masked language model and pseudo-log-likelihood scores (PLL) to estimate the sequence probability based on the bidirectional representation of the concatenated sequence comprising the source text and the candidate. This thesis uses contrastive learning during training to increase the probability difference between the true sequence and unmatched sequences, expecting to enhance the ability of the LMR to distinguish between them, thereby mitigating issues such as text degeneration. Experimental results on the RST-DT dataset demonstrate the effectiveness of LMR in discourse segmentation and sentence-level discourse parsing tasks.

Building upon the success of the LMR, this thesis extends it to a seq2seq architecture, resulting in the BTR. The BTR preserves the seq2seq-style Transformer architecture and incorporates a masked language model in the decoder component to re-estimate the probability of each candidate through PLL based on the corresponding bidirectional representations. During inference, the BTR compares the re-ranked top-1 results with the original ones using an acceptance threshold  $\beta$  to determine the final results. Experimental results on three publicly available grammatical error correction datasets demonstrates the effectiveness of BTR in overcoming exposure bias and text degeneration.

The experimental results presented in this study provide strong evidence for the effectiveness of the proposed re-ranking-based methods in addressing decoding problems. Moreover, these results suggest that future research could explore the potential benefits of combining PLL-based and discriminative models. Building upon these findings, this thesis offers valuable insights into potential directions, including label embedding, masking, and negative sampling strategies, to benefit the NLP community.

備考 : 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

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