Research Statement

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My general research interests mainly lie in Natural Language Processing (NLP) and Machine Learning (ML). Recently, I am focusing on Information Extraction (IE), especially Relation Extraction (RE).

The challenges of RE occur in two scenarios: i) the generation of labeled data, which is very costly via human labor while very noisy via automatic techniques like Distant Supervision (DS), and ii) the building of extraction models which don't suffer from human annotation dependence and can effectively exploit context information along with external knowledge. I am interested in both directions.

During the pursuit of my Ph.D. degree at Southeast University, I have not only obtained a broad background in IE, but have also accumulated extensive experience in this field. I have researched a RE model based on Reinforcement Learning, which can exploit external evidence of relations and prior knowledge of relation patterns. Besides, I explored the generation of training data based on Adversarial Learning, which can reduce the noise in DS-generated data effectively with handful human participation. In addition to my own research, I have supervised two Master students on projects related to the implementation of software component for RE.

More details with regard to the research I have done are provided below, followed by an outline of my further research plans.

Current Research

My current research work has covered two directions of RE: novel RE models and automatic generation of training data.

- **Relation Extraction based on Reinforcement Learning**

Various RE models have been proposed to extract semantic relation of entities from text. However, the extraction performance has already met the bottleneck. The lack of sufficient context information is a main obstacle to improve RE performance.

In order to alleviate this problem, I have attempted to introduce external evidences of potential facts and human knowledge (low-cost manual patterns) to the RE process. An RL framework was used to incorporate basic relation extractor, relation evidences and low-cost human patterns and a better extraction performance was achieved than the original relation extractor.

- **Adversarial Discriminative Denoising for Distant Supervision Relation Extraction**

Distant supervision for RE can generate training data automatically by aligning KB with text. However, DS will also bring about much noise. The noise will hinder the performance of DS based RE models trained on such noisy data. Previous works have focused on building DS

models with noise adaptability. The problem is, they did not remove the noise explicitly so that they cannot avoid the side effect of noise. To enable explicit noise reduction, a few challenges need to be addressed.

The first challenge comes from the lack of an effective way of introducing explicit supervision to the denoising process. The existing work that remove the noise explicitly are mainly unsupervised and could not achieve remarkable denoising effect. Another challenge relates to the evaluation of the denoising result, which caused non-differentiability problem to the optimization of the whole model.

To solve the above challenges, we propose an adversarial discriminative denoising framework, which can not only acquire the denoising ability by exploiting the beneficial information underlying DS-generated data but also further get boosted via introducing very little human annotations efficiently. To guarantee the model differentiable, we employ a continuous approximation of sampling action when evaluating the denoising result, which helps fast convergence. Compared with state-of-the-art methods, our approach can achieve significant improvement just using very little human supervision and has better applicability when the noise proportion is large.

Future Research

For future research, I am open to all problems related to NLP and ML. I am particularly interested in working on IE. A few of my specific interest are outlined as bellow.

Designing novel models for RE:
(1) Pay attention to document-level (cross-sentence) RE instead of sentence-level RE. In this case, the context information is more abundant and may be exploited to improve RE performance.
(2) Explore better knowledge representation method. Current mainstream methods are based on DL and word embedding. However, the information provided by word embedding are not disentangled and may be not sufficient for RE.
(3) Address fine-grained and hierarchical RE, which is more applicable in practice.

Reducing human participation in RE task:
(1) Augment the labeled data via text generation to solve the problems such as the long-tail problem of relation patterns and the low-quality problem of negative samples.
(2) Reduce the need of training data by exploiting the existing data of other domains, other tasks and other languages.
(3) Explore human-model interaction (human-in-the-loop) modes to improve the efficiency of human participation in RE.