先端科学技術研究科　修士論文要旨

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要旨

In recent years, the world is becoming more globalized and the world requires mutual understanding across borders. Learning a foreign language to a native level is difficult, but we can use machine translation. Machine translation models based on neural networks have developed rapidly and are able to produce more fluent translations than traditional statistical machine translation.

However, a lot of problems remain to be solved. It has been said that language pairs with different orders are especially difficult for machine translation. This paper is important for such pairs like English-Japanese.

One of the problems is the translation of long sentences. Most neural machine translation models process the entire long sentence all at once, which can lead to omissions of necessary words and incorrect sentence structure. In statistical machine translation, there is a method to divide the sentence into clauses, translate each one, and then reorder them. We propose to apply this idea to neural machine translation. The results of the English-Japanese translation experiments showed the possibility of preventing missing necessary words in long sentences and correcting syntactic structures. It turned out that the neural machine translation model could also be used for reordering.

Another important problem is simultaneous translation. In simultaneous translation, the translation starts before the speaker has finished speaking. Therefore, it is more difficult than full-sentence translation because the former part of the sentence has to be translated without using the latter part as context. It is important to decide when to start the translation, but it is difficult especially for language pairs with different word orders, such as English-Japanese. To improve accuracy in such language pairs, we propose a method that predicts which syntax constituent will come next after the current prefix of the sentence. Based on this, we propose simple rules for English-Japanese translation to find the boundary and start translating that prefix segment. The proposed method makes it easier to control the latency and the syntactic structure of the translation. Experiments on simultaneous translation from English to Japanese showed that the proposed method outperformed the baselines in the quality-latency trade-off.

In this thesis, we have shown the effectiveness of syntax-based segmentation for long sentence translation and simultaneous translation. In the future, we need to improve the accuracy of segment translation and automatically extract segmentation rules to find better segment boundaries. It is also important to find better ways to combine segment translations. By improving them, we expect to realize more accurate machine translation while maintaining the interpretability of the syntactic structure of translation, and the proposed methods can be effectively applied to other language pairs.