Look it up: Bilingual and Monolingual Dictionaries Improve Neural Machine Translation

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Rare Word Problem

- Still a challenge in NMT
- Dictionaries:
  - Useful in rule-based MT and Statistical MT
  - Not commonly used in NMT
# How Dictionaries Are Used

| Chinese | English |
|---------|---------|
| 大家 都 知道 死海正在 死亡 | Everyone knows the Dead Sea is dying |
| 我哥哥听说我们做了火药 | Well, my brother heard that we had made gunpowder |

| Chinese | English |
|---------|---------|
| 死海 | Dead Sea |
| 火药 | gunpowder |

append
Our Approach

Original sentence: 大家 都 知道 死海(UNK) 正在 死亡

Unknown word: 死海

Dictionary Entry: 死海: the Dead Sea
Results on Word Based Models

Word-based results in BLEU

- Baseline
- Append
- Attach (ours)
Results on BPE Based Models

BPE-based results in BLEU

Baseline  Append  Fuse  Attach

Zh-En Spoken  Zh-En Science  Zh-En Laws  Zh-En News  Zh-En Education  Zh-En Subtitles  Zh-En Thesis  Zh-En All  De-En Small  De-En All
Macro F1 on BPE Based Models

BPE-based results in Macro F1

- Baseline
- Append
- Fuse
- Attach
Macro F1 on BPE Based Models

BPE-based results in Macro F1

Farsi-panlex  | Farsi-wikidata  | Farsi-combined
---|---|---
Baseline: 16.0 | Baseline: 19.0 | Baseline: 18.0
Append: 16.0 | Append: 19.0 | Append: 18.0
Attach: 16.0 | Attach: 19.0 | Attach: 18.0
Example

Source sentence BPE: 我 哥哥 听说 我们 做 了 火@@ 药。

Dictionary Entry: 火药: gunpowder

Reference: Well, my brother heard that we had made gunpowder.

BPE Baseline: My brother had heard that we did a fire pills.

Attach: My brother heard that we did the gunpowder.
Conclusion

• Definitions not equal to translations.
• Don’t force the NMT to generate definitions.
• Appending dictionaries may hurt the system.
• Attaching dictionaries improves translation quality and can work on monolingual dictionaries.