Translating a low-resource language using GPT-3 and a human-readable dictionary

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Inuktitut: a polysynthetic language

Long words composed of many content and functional morphemes:

\[ savigginuqnaqtutit \]

savik- ggiq -runnaq -tutit

snow.knife -bring -ABIL -2S

“You can bring your knife.”

An inexperienced speaker cannot easily use individual morpheme definitions, or even the gloss, to understand such a word.
Resource development: NMT

Large corpus

Fine-tuned NMT

savigirunnaqtutit → you can bring your knife

Translator app

But we may need a lot of data!
Resource development: human-focused

Example

savigirunnaqtutit
« You can bring your knife. »

Related Morpheme:

savik
« (1) metal; steel; iron (2) snow-knife »

:ggig:
« to bring someone or something along »

:runnaq:
« to be able to perform a certain action »

:tutit
« you »
This work: translation with human-readable materials

Communities often want human-readable grammars and dictionaries, and may invest significant effort in building them.

They provide material for learners and inexperienced speakers, written in a well-resourced language.

Can we use the **monolingual text-to-text** abilities of large LLMs to leverage this material?
Previous work

Focus on adding dictionary resources to NMT (Luong et al. 2015, Zhang et al. 2021, Niehues 2021, Ghazvininejad et al. 2023).

Our contributions:

1. Do this **without** a base NMT system
2. Target a polysynthetic language.
3. Also map from whole-word translations to suggested definitions (the reverse task)

Translate the following sentence to English:

_Pada dasarnya, hal tersebut terbagi ke dalam dua kategori: Anda bekerja sambil mengadakan perjalanan atau mencoba mencoba atau membatasi pengeluaran Anda. Artikel ini berfokus pada hal yang terakhir.

In this context, the word "sambil" means "while"; the word "membatasi" means "limiting", "restrict", "limit".

The full translation to English is: Basically, they fall into two categories: Either work while you travel or try and limit your expenses. This article is focused on the latter.

Translate the following sentence to English:

_Ia melakukan pembuatan bel pintu dengan teknologi WiFi, katanya.

In this context, the word "pembuatan" means "creation"; the word "bel" means "buzzer", "bell"; the word "pintu" means "door", "doors".

The full translation to English is:
Dataset

Dictionary example words with English definitions scraped from Uqausiit dictionary:

`saviggirunnaqtutit` → you can bring your knife

Segmented into canonical morphemes using dictionary-provided structure, filling gaps with FST segmenter (Farley 2012)

`saviggirunnaqtutit` : `savik ggiq runnaq tutit`

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The Inuktitut word saviggirunnaqtutit is made up of the following parts:

savik: (1) metal; steel; iron (2) snow-knife; or, to be fitted with a metal point (harpoon; spear)

ggiq: to bring someone or something along, as in "Don't bring your gun along."

runnaq: to be able to perform a certain action, as in "Could you find that out if he/she arrived"

tutit: you, as in "you sleep"

In English, saviggirunnaqtutit means roughly: you are able to bring a snow-knife
Prompt tuning: questions

Baselines:
- Translation without the definitions (does GPT-3 know Inuktitut already?)
- Concatenate the definitions in order

To what extent does GPT-3 benefit from:
- Dictionary usage examples
- Different ways to elicit multiple answers when morphemes have multiple definitions
- A tiny “grammar lesson” explaining some compositional phenomena
- Chain-of-thought prompting
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<td>(1) metal; steel; iron (2) snow-knife, to be fitted with a metal point (harpoon; spear) to bring someone or something along to be able to perform a certain action you</td>
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GPT-3 does not know Inuktitut.

Text-to-text generation is required.
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Definitions help!

Asking for multiple answers is useful if the user has contextual cues for which one is right.

GPT-3 is not great at applying grammatical information to concrete examples.
Definition induction

The Inuktitut word niriligiaqtut is made up of the following parts:
niri: (currently unknown)
giaq: to start to do something; to try to do something
liq: an action that is underway or starting; also marks a change from one state to another
tut: they (3+)

In English, niriligiaqtut means roughly: "they have started to eat"
"niri" probably means "eat".

Results are not as good as for translation, but show promise for root morphemes.
GPT-3 can usefully translate polysynthetic words by composing English definitions.

Potentially useful for communities which are investing their time in dictionaries and grammars rather than corpora.

Future work? Better prompts, even more powerful LLMs, incorporation of segmentation and disambiguation within the few-shot framework.

See the paper: more examples, definition induction results, BLEU scores, confidence intervals, ethics discussion.

Thank you / qujannamiik!