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Artificial Intelligence in the Process of Simultaneous Translation

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ABSTRACT
Artificial intelligence, like translators, has the ability to quickly translate communication from one language to another at the same time. Until recently, it was considered just a fantasy. But today we can see that any person standing in different corner of the world can talk to people of other nationalities as if they were talking in their mother tongue. This is done on the basis of ordinary headphones, with the help of artificial intelligence. In many conferences, simultaneous interpretation is also done on the basis of artificial intelligence. When a speaker is speaking in one language, the listener is able to hear him in his own national language with the help of an artificial translation service. Despite the many advantages of using this type of computerized translation service in the simultaneous translation process, there are also some misunderstandings in the translation process.

KEYWORDS: machine translation, rules-based translation, neural machine translation, Open's AI's ChatGPT, disadvantages, benefits.

Technologies that can implement simultaneous translation are used all over the world today. Kudo is one of the companies that have introduced such technologies into their operations. The main purpose of this technology is not to translate written texts, but to translate spoken speech. Participants of the same video conference will hear the translation as if they were hearing from the translator himself.[1] But the company's product manager, Tzachi Levy, uses this technology to speak in English and the machine translates it into Spanish. Although the translation sounded like a human translation, there were many delays in the translation process and the voice sounded like a robot. In this case, it is concluded that despite the fact that a person is a factor capable of high-precision translation, these technologies are not without benefits[2]. It is not unlikely that the speaker will add his own voice to such developing technologies. Even some companies have already tried this experiment. But this translation did not happen simultaneously. This is Elevenlabs' platform and can translate into 30 different languageswith the same voice. In this, the user uploads his voice and the platform translates his voice into the language of his choice without changing it. The most popular translation platforms are Google translate and Microsoft translator both of which are capable of translating both spoken and written languages. They build on all the existing knowledge of natural language processing - including grammar, language understanding and language generation and quickly produce translations into hundreds of different languages. With the help of these types of devices, different types of businesses can create simultaneous multilingual communications. Machine translation helps organizations better engage with customers and exchange ideas around the world by easily translating written and spoken materials from one language to another. There are several types of Machine Translation and each of them has its own approach, these are rules-based, statistical, hybrid, neural machine translations.

[1]Chernov G. V. Simultaneous interpretation: speech compression-linguistic problem// Notebooks of a Simultaneous interpretation.-M., 1969.
[2] X. hamidov, N. ismatullayeva, S. Ergasheva . Sinxron tarjima. O'quv qo'llanma. T.:-2020.

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- **Rules-based machine translation** was initially based on manually programming the grammatical rules of bilingual dictionaries into computers. This machine translation relies on language and word rules. Therefore, this approach requires a dictionary for both languages. Then the program performs the translation process based on grammatical and syntactic rules, looking for the alternative of the words in the second language. But this program is not able to make the translation highly accurate and sometimes you have to edit the translation. This approach is used in a simple translation process, for example to understand the main idea ofa text.
- **Statistical machine translation** — since the beginning of the 21st century, machines that can work with statistics have been used in translation. These types of machines have the ability to analyze text and find the best alternative for specific words or phrases in one language in a second language. However, this type of machine can give a wrong meaning in some cases.
- **Hybrid machine translation** is a combination of different translation machines. In most cases, rule-based and statistical translation types are used. This method, like any other type of machine translation, is subject to some errors and requires a human factor to make sense of it.
- **Neural machine translation** is one of the types that are becoming popular today, it can work with a very large database and translate based on the meaning of the whole sentence instead of working with individual words like other methods. A more recent breakthrough in neural machine translation was the creation of transformer neural networks — the "T" in GPT, which powers large language models, or LLMs, like OpenAI's ChatGPT and Google's Bard. Transformers learn patterns in language, understand the context of an input text and generate an appropriate output. This makes them particularly good at translating text into different languages.[3]

Using a technique called "self-attention," transformers can selectively focus on different parts of an input sentence, weigh their importance based on how relevant they are to each other, and identify important relationships between them so that it can accurately translate them into another language. They are also trained on massive amounts of bilingual text data, which helps them learn the nuances of different languages and improves their ability to generate accurate translations.

"With transformer models you also predict [the next word], just like any large language model. But you predict it in context," Olga Beregovaya, the VP of AI and machine translation at translation company Smartling, told Built In. "While large language models are trained for a variety of tasks, the latest generation of LLMs equally performs well on translation tasks."[4]

At its most sophisticated level, machine translation is essentially a form of generative AI, where LLMs are used to automatically produce text. For instance, if a user prompts ChatGPT in English to give them a chocolate éclair recipe in French, the output is an example of machine translation. This type of machine translation is very useful in the process of simultaneous translation. Because this method of translation increases productivity and is relatively affordable, and ongoing developments mean that in the near future there will be no need for human translation. But this does not mean that machines can completely replace human translation. Only the profession of translators will change. They make the rules that these machines have to follow. In other words, they become software engineers.

When we look at the human side of simultaneous interpretation, we see that interpreters rely heavily on prediction theory to anticipate the speaker's intended meaning and potential upcoming words or phrases. By doing this, interpreters can swiftly and accurately translate the message into the target language without

[3] https://builtin.com/artificial-intelligence/machine-translation
[4] https://www.degruyter.com/document/doi/10.1515/les-2017-0023/html?lang=en

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falling behind the speaker. On the other hand, AI language models, such as GPT-4, leverage massive datasets to discern patterns and associations within text, enabling them to predict the next word or generate contextually sensible text using probability distributions over their vocabulary.

Now, let's delve into the interesting parallels between human interpreters and AI language models:

1. **Listening and Comprehension ↔ Data Ingestion:**
   - Interpreters listen and comprehend spoken language, while language models analyze and learn from textual data, recognizing patterns and relationships between words.
2. **Short-term Memory Retention ↔ Context Window:**
   - Both human interpreters and language models temporarily retain information. For language models, this is represented by a context window, which allows them to consider recent words and their interdependencies.
3. **Semantic and Contextual Analysis ↔ Pattern Recognition:**
   - Both interpreters and language models engage in semantic and contextual analysis to grasp the intended meaning. Language models are proficient at recognizing patterns and relationships in text, thereby predicting the most likely next word.
4. **Translation ↔ Word Prediction:**
   - Interpreters translate the message, whereas language models generate the most probable next word utilizing the patterns and relationships they've learned from the data.
5. **Production ↔ Text Generation:**
   - Just as interpreters produce the translated message, language models generate coherent and contextually appropriate text.[5]

These parallels between human simultaneous interpreters and large language models illustrate the tremendous progress in AI-driven language models. However, it's essential to acknowledge that human interpreters possess a distinctive understanding of intricate cultural nuances, emotions, and idiomatic expressions. Additionally, human interpreters can apply critical thinking and ethical considerations, whereas AI models are delimited by the extent of their training data.

By acknowledging these parallels, we gain a deeper understanding of the intricacies of language processing and the potential for AI to revolutionize language translation and text generation.

The galaxy's aspiring travelers, prepare for delight: Baidu, the Chinese tech behemoth, has developed a translation system that propels us closer to a software incarnation of the Babel fish.

For those unacquainted with the genius of Douglas Adams' science fiction, let me fill you in. The Babel fish is a slippery, fictitious creature that takes up residence in human ear canals, tapping into their neural systems to provide instantaneous translation of any language they hear.

In the real world, until now, we've relied on human and software interpreters to keep pace. However, Baidu Research's new AI-powered tool, known as STACL, could significantly accelerate this process. It employs a sophisticated form of natural language processing that lags only a few words behind and stays current by predicting the future.

Principal scientist Liang Huang notes, "What's remarkable is that it predicts and anticipates the words a speaker is about to say a few seconds in the future. That's a technique that human interpreters use all the time—and it's critical for real-world applications of interpretation technology."

[5] https://www.linkedin.com/pulse/language-processing-prediction-comparing-human-ai-models-cannan

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STACL (Simultaneous Translation with Anticipation and Controllable Latency) is akin to the human interpreters stationed in booths during UN meetings. These individuals have a taxing job. As a dignitary speaks, the interpreters must simultaneously listen, mentally translate, and speak in another language, usually lagging only a few words behind. It's such a demanding task that UN interpreters usually work in teams and take shifts of only 10 to 30 minutes.[6]

A task requiring that kind of parallel processing—listening, translating, and speaking—seems ideally suited for computers. However, until now, it was deemed too difficult for them. The best "real-time" translation systems still primarily employ consecutive translation, waiting for each sentence to conclude before rendering its equivalent in another language. These systems deliver highly accurate translations, but they are slow.

The major challenge in simultaneous interpretation arises from word order differences in various languages. Huang explains, "In the UN, there's a famous joke that an interpreter who's translating from German to English will pause and seem to get stuck. If you ask why, they say, 'I'm waiting for the German verb.' In English, the verb comes early in the sentence, while in German, it comes at the very end of the sentence."

STACL overcomes this obstacle by predicting the upcoming verb, based on its observations of countless sentences in the past. The Baidu researchers trained STACL on newswire articles where the same story appeared in multiple languages. As a result, it excels at making predictions about sentences related to international politics.

The researchers demonstrated STACL's capabilities in translating from Chinese to English in their current paper (illustrating significant differences in word order between the two languages). Huang states, "In principle, it can work on any language pair. There's data on all those other languages. We just haven't run those experiments yet."

Undoubtedly, STACL can make errors. Were the French president's visit not to go as planned and Xi Jinping instead expressed regret and dismay, the translation would contain a glaring mistake. Presently, it lacks the ability to rectify its errors. "A human interpreter would apologize, but our current system doesn't have the capability to revise an error," Huang explains.

Overall, Baidu's STACL represents a significant leap forward in the realm of simultaneous interpretation, potentially paving the way for transformative advancements in language translation and AI-driven communication. However, the system is flexible, allowing users to adjust and balance between speed and accuracy. For instance, if STACL is set to have a longer delay—lagging five words behind the original text instead of three—it has a higher likelihood of producing accurate translations.

Additionally, its accuracy can be enhanced by training it in a specific subject area. For example, by familiarizing it with the types of sentences commonly used in presentations at a medical conference. As Huang puts it, "Just like a human simultaneous interpreter, it would need to do some homework before the event.")

This capacity for adjustment and specialization mirrors the way human interpreters also prepare and adapt to provide precise and contextually appropriate interpretations.

In conclusion, although there are many useful aspects of using artificial intelligence in the process of simultaneous translation, it is not equivalent to the human race.

[6] https://exceltranslations.com/baidus-ai-simultaneous-translation/

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