

## ARTIFICIAL INTELLIGENCE TRANSLATION AND MACHINE TRANSLATION IN EDUCATION

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### **Introduction**

Machine translation has been in the spotlight for a long time now.

While the term “machine translation” has been around for decades, the rise of artificial intelligence is pushing the boundaries of what automated translation can do. As a result, there is now a distinction between traditional “machine translation” and modern “AI-based translation.”

Machine translation (MT) first emerged in the mid-20th century with the desire to automate the labor-intensive task of translating text between languages. Early systems were largely rule-based, meaning they relied on linguistic rules, dictionaries, and carefully designed algorithms to translate source text into the target language. These systems required extensive linguistic knowledge and the creation of heavy-handed rules, which were difficult to build and maintain.

### **Main body**

In the late 1980s and early 1990s, researchers began using statistical methods. These systems used large parallel corpora (i.e., text in two or more languages) to determine translation probabilities. Phrase-based systems looked at words or word sequences in the source language and determined their most likely equivalents in the target language based on their frequency in the training data. This approach was superior to rule-based systems and helped produce more fluent translations, although some less frequently used words, longer sentences, and context presented challenges.

Artificial intelligence has led to another major breakthrough in translation technology: neural machine translation (NMT). NMT uses artificial neural networks to model the translation process from start to finish, considering the entire sentence at once. This focus on the sentence (and sometimes the broader context) has resulted in more fluent and consistent translations.

While “AI-based translation” is primarily understood as “neural machine translation,” the term can also encompass other deep learning strategies, including large language models and advanced generative models that incorporate linguistic context, user intent, or domain-specific training. These developments are leading to continuous improvements in translation accuracy, speed, and handling of idiomatic expressions.

M. Mahmudov writes that machine translation is the process of translating written texts and spoken speech from one language to another with the help of special computer programs. He writes that the direction of scientific research related to the creation of such systems is also called *machine translation* [Mahmudov M., 2024, p.76].

The main differences between machine translation and AI translation are:

## I Methodology

Machine translation: A system that has historically been used, either rule-based or involving statistical approaches. These methods are based on predefined rules or probability distributions based on large corpuses of text.

AI-based translation: Typically uses neural networks or advanced deep learning architectures. The model learns contextual relationships within sentences (and sometimes larger contexts) rather than relying on explicit human-defined rules.

## II Contextual:

Machine Translation: Traditional systems break sentences down into smaller, independently processed segments (e.g., individual words or short phrases). This limits the system's ability to reflect long-term context.

AI-based translation: Neural networks can reflect entire sentences (or paragraphs) to gain a higher level of context understanding. This makes AI-based systems more adept at picking up idiomatic expressions and ambiguous phrases based on surrounding words for clarity.

## III Accuracy and fluency:

Machine Translation: Based on prior rules and incorporating linguistic nuances through statistical methods, it can sometimes produce translations that are often grammatically awkward or incorrect in certain contexts.

Artificial intelligence-based translation: Current neural approaches produce more natural-sounding translations and more accurately handle complexities such as verb conjugation, gender, tense, and style.

## IV Compatibility:

Machine Translation: Adding new languages or improving accuracy typically requires collecting new text corpuses or manually modifying rules. This process can be slow, expensive, and resource-intensive.

Artificial Intelligence-Based Translation: Can retrain or fine-tune models using additional parallel texts with the correct structure, domain-specific terminology, or user feedback. While it also requires data, modern hardware and machine learning techniques have made it easier to adapt models to new scenarios.

Machine Translation: Statistical MT can struggle with words that are not commonly used in the training data, which can lead to poor translation quality or outright failures.

AI-powered translation: While still relying on training data, neural models can better generalize unfamiliar words by breaking them down into units. This makes it easier to handle new terms more dynamically.

Most major translation providers, such as Google, Microsoft, and others, have adopted neural approaches. Many enterprises rely on these powerful models to localize content and facilitate global communication. In addition, emerging AI-powered platforms offer specific customization, allowing companies to fine-tune models for specialized fields such as legal, medical, or technical documents.

Machine translation (MT) systems are applications or online services that use technology to translate text between any supported languages. Before the adoption of MT, translation was largely a manual process. Today, translators often work with MT tools to become significantly more productive. These technologies have transformed the translation and localization industry, providing increased productivity, reduced costs, improved consistency, and the ability to easily manage terminology for scalability.

While the concepts behind MT and the interfaces for using it are relatively simple, the science behind it is complex and combines several advanced technologies.

New options have emerged in machine translation. One of these is Generative Artificial Intelligence (GenAI). GenAI relies on Big Language Models (LLM), which are AI models that consume large datasets and are professionally trained. They currently represent a major advantage in translation systems.

These models can generate new texts that mimic natural language based on training data.

It should be noted that the development of GPMs has been a gradual process. The first GPMs were relatively small and could only perform simple language tasks. However, with advances in professional neural networks, larger and more powerful GPMs have been created. The 2020 release of the Generative Pre-Trained Transformer 3 (GPT-3) model was a significant milestone in the development of GPMs. GPT-3 demonstrated the ability to generate consistent and natural-sounding text. GPT-3 and subsequent models have been trained on datasets in many languages and can therefore produce output in those languages [Mustafayeva S.B., 2025, p.170].

K.Dorothy writes that NMTs have the potential to outperform NMTs in terms of cost, speed, and translation quality, and they also allow for the development of natural language processing features in multilingual applications. However, NMT and NMTs each have their own strengths and weaknesses. While NMT may be the most suitable technology for some translation tasks, NMTs may be more meaningful for others [Kenny D., 2022, p. 92]

There are some similarities between these two translation models:

They are both pre-trained using a bilingual (or multilingual) corpus.

Both can be trained or tuned to perform specific tasks better.

However, there are also significant differences between them:

For specific domains, such as healthcare, NMT is easier and cheaper to tune.

### **Conclusion**

LLMs generally produce more natural-sounding text, while NMT produces more accurate text.

NMT typically processes text segment by segment, while LLM can work on entire documents at once. Thus, LLMs work better with open context.

It can be easier to integrate existing dictionaries and term bases with NMT than with LLMs (Mustafayeva, 2025).

Currently, NMT is faster than LLMs, but newer LLMs are better than older LLMs. Speed can be a serious concern for processing large amounts of text.

Currently, translation processing using LLMs is more expensive than NMT. This is especially true for low-resource languages.

NMT can be optimized for language variants. For example, LLMs may have difficulty differentiating and preparing text for language variants such as Portuguese for Portuguese and Brazilian Portuguese for Portuguese (Kenny, 2022).

NMT is specifically optimized for translation, while LLM can be used for a variety of language processing tasks. For example, LLM can be used to create business emails in Japanese.

## **References**

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