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Abstract

With the expansion of the sphere of human-machine communications, the problem of machine translation of written texts from one language to another has become the main subject of scientific, technical, economic and commercial issues of human activities. Information machine translation (MT) seems "rough" in quality. As a matter of fact, it may differ from the traditional norms of the converted language. Yet, it is becoming one of the most important tools of modern science and technology. It is helpful for the intensification of the world's economy as well as its social development and people's interaction within cultural, economic and trade industrial activities. The present paper examines the historic development of machine translation technologies starting from the 17th century up to the present day. The authors single out the distinctive features of machine translation in comparison with computer-aided and manual translation systems. They strive to establish the advantages and disadvantages of each translating means. The definition of machine translation is given in its difference from the manual and computer-aided translation systems. Three types of machine translation tools are presented with an overall comparison of their distinctive functions. A list of modern MT systems is provided with linguistic justifications on the point of their structure and practical usage.

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1. Introduction

The widespread introduction of information technology significantly accelerates the various processes of human activity, among which communication occupies a central place. The success of conducting intercultural communications sometimes depends on the professional activities of translators who participate in communicative acts, conveying the meaning of statements from one language to another. Automation of translation processes allows you to minimize the time of its implementation.

1.1. Widespread relevance of the present study

Adaptation of the latest machine technological systems to the needs of converting textual information from one natural language to another, globalization processes confirm the relevance of this work. The lack of fundamental research in the field of automated processes for collecting, transmitting, storing and processing information in foreign languages reinforces the massive need for the current study.

1.2. The extent of the subject study

The concept of machine translation has attracted the attention of linguists since the middle of the 20th century. The study of this direction, as well as the development of application programs for the processing of linguistic information, is carried out by a special section of linguistics, called computational linguistics.

2. Problem Statement

Machine translation technologies have firmly entered the life of a modern person. The term “machine translation” (MT) is the process of translating written texts from one natural language into another using a special computer program (Marchuk, 2007). The translating program can be installed directly on a computer (or mobile device) or be available only when connected to the Internet.

2.1. Chronologic development of MT

Half a century ago, in order to read an article in a foreign language or translate a letter received from abroad, people used dictionaries or hired professionals to serve them. Currently, it is habitual for any user to address an online translator or any other mobile appliance. The evident machine’s availability, simplicity and efficiency are due to the work of scientists, mathematicians, engineers, and linguists.

2.2. The impact of international relations

The development of MT contributes to the expansion of international relations. Over the past decades, scientists, engineers, mathematicians and linguists have carried out a technological revolution, transforming traditional methods of translation into automatic ones with the help of computer innovations and digital information reprogramming systems. Machine translation technologies are widely used by the

vast majority of people who apply to mobile translators, online services that are publicly available in two modes, i.e. online and offline

3. Research Questions

Modern society is in need of instant information awareness of global events. This objective necessity sets out the task of developing the theory and practice of machine translation. Machine systems are known to produce an efficient implementation of full or fragmentary translation of micro-texts, i.e. headings, key phrases, slogans, etc. Their automatic mode of operation attracts attention for further investigations to be carried out about the stated matter.

4. Purpose of the Study

The scope of global communications via modern technologies leads to problems of machine translation of written texts from one language to another. The society's need for information awareness of global events sets the task of developing the theory and practice of machine translation.

4.1. Studying of modern digital technologies

Digital competitiveness has given rise to the development of machine translation technologies, creating new systems and modernizing existing ones in digital mode. The industrial development of information technologies has advanced the field of translation studies by several steps forward, providing an opportunity for its improvement. The present study is devoted to the consideration of modern machine translation systems used to carry out translation activities.

4.2. Identifying features of modern MT means

Researches are made to consider the most fluent ways of MT with the help of modern technologies. In this regard, it is worth considering the features of the largest MT systems of modern times.

5. Research Methods

The methodological basis of the study is a comparative analysis of the scientific papers devoted to the studied issue of machine translation. The workframe of the study applies such methods as: abstract review, comparative analysis, synthesis, generalization of the studied material.

6. Findings

Machine translation emerged in 1836 when Charles Babbage (1791–1871) presented a design for a mechanical type of analytical engine. His machine was made to store large volumes of vocabulary databases (Shilov, 2011). Unfortunately, his project was not implemented in practice. Half a century later, the French inventor Georges Artsruni received a patent for the development of the "Mechanical Brain" - the first translation device, the whole essence of which was to store vocabulary lists of words on paper (Mitrenina,

2017). Two months later, the Russian scientist Troyansky became the owner of the second patent for a transfer device (USSR patent No. 40995 of September 5, 1933). The functionality of his machine required two editors or the native speakers of two working languages. The first editor had to enter the original form of each word into the machine which was expected to translate. The second editor was intended to edit the produced material by the machine into the literary form of his native language (Mitrenina, 2017).

6.1. The emerging need for the MT development

Alongside the arising need to create more advanced forms of communication on the material level, the level of coding has changed. In 1947, Warren Weaver set the task of translating one Russian text into English using encryption technologies. His theory of MT sounds as follows: “All you need to do is to strip off the code in order to retrieve the information contained in the text” (Andreeva, 2021, p. 44). Weaver’s hypothesis reflects an attempt to build an analogy between translation and decryption operations. Due to the achievements in cryptography during the Second World War, his attempt seemed quite reasonable.

The application of machine translation started to take shape in 1954, when an English text presented to the public was translated with the usage of IBM computer technology. This event dates back to the famous Georgetown Experiment which is based on limited resources, i.e. 250 vocabulary units and 6 grammar rules. However, the first MT system, demonstrated in New York, marked the creation of high-quality automatic translation systems that were to replace the work of professional translators in a short period of time.

6.2. Present definitions of machine translation

Currently, the linguistic literature has several definitions of the studied concept. Researchers distinguish three concepts of existing translation systems, i.e. machine, manual and computer-aided translations.

- *Computer-Aided Translation* is the translation of texts on a computer, carried out by the translator himself, using computer technologies (Popov & Zhukova, 2014).
- *Machine Translation* is the action performed on a computer to convert the text of one natural language into the equivalent text of another language, and the result of this conversion (Usacheva, 2008).
- *Manual Translation* is a creative activity that includes diverse forms of re-expression, recoding of texts from one language into another, carried out by a translator, and the result of translating activity (Alekseeva, 2006).

6.3. Modern tools of machine translation

Modern MT tools are electronic dictionaries, translation memory systems, MT systems, which are used to save time when translating large volumes of texts. Professor Bouate distinguishes three types of MT which are based on the differences of their translation quality (Table 01).

Table 1. Types of machine translation

Informative MT	Professional MT	Personal MT
rough, word-by-word, sufficient to understand the essence of the source text	identical to the manual translation, on the condition of post-editing at the final stage	the quality of this translation depends on the quantity of ambiguities in the source text

The global information network has spawned a number of commercial translation systems, such as, Systran, Lingvo, Transparent Language, IBM, Language Engineering Corporation, Trados, Trident Software (Novozhilova, 2014).

The Internet has made significant changes in the work of a translator, opening up the opportunity to enter the global information space. In addition to the flexibility of its localization, the arsenal of a modern translator includes electronic tools that can speed up and even simplify the process of long-term translation. The machine translation systems include:

- 1) electronic translation dictionaries – Lingvo, Multitran, Babylon, Polyglossum;
- 2) systems of the class of translation memory (Translation Memory) – Trados, Déjà vu, Wordfast;
- 3) programs for automatic text editing – Punto Switcher, Notepad, EditPlus, Bred (Usacheva, 2008).

Considering the types of MT systems identified in science, the first type includes machine translation systems based on grammatical rules (Rule-Based Machine Translation or RBMT). These systems use the classical approach of decoding linguistic information from one language to another due to the monolingual, bilingual and multilingual dictionaries and grammars embedded in them. Prominent examples of grammatical rule systems include Systran, Eurotra, and Japanese MT systems. The advantages of these MT systems are their grammatical and syntactic coherence of presentation. The quality offered by the systems justifies their expensive cost.

The second type of MT systems combines statistical systems (Statistical Machine Translation or SMT), the history of which originates from the theory of Warren Weaver (1947), who made an attempt to translate based on the generation of statistical models of the languages used in translation. Warren Weaver's idea of generation was developed in the IBM system in the early 1990-s, and then in the Google Translate, Language Weaver, Yandex Translate systems.

Having abandoned the services of Systran, Google's management set is not based on grammatical rules (see grammatical rule-based systems), but on the use of statistics (statistical systems). To implement this type of MT, a large corpus of linguistic correspondences is required, in which each sentence in one language has a pair with an identical meaning in another language. Machine classification distributes parts of sentences according to the frequency of their use in speech. Based on the fragmented parts, they are generated as part of the translated text. This approach underlies the statistical systems of MP (Mitrenina, 2017).

Hybrid Machine Translation, or HMT, are the third type of MT systems. Hybrid MT technology is based on the integration of existing MT approaches into a single whole:

- Rule-Based Machine Translation
- Statistical Machine Translation
- Corpus-Based Machine Translation
- Example- Based Machine Translation.

Initially, it was assumed that hybrid translation systems would combine the advantages of existing MT into a single unity. Hybrid translation is carried out by combining the first two types of MT - MT based on grammatical rules and Statistical MT. However, there are examples of the use of two other types of MP as part of a hybrid one. Thus, researchers at Carnegie Mellon University managed to combine MT subsystems based on examples and texts, as well as statistical MT systems (Bowker, 2002).

A significant stage in the development of MT was the transition of companies such as Microsoft, Prompt, Google and Yandex to the technology of artificial neural networks in MT (Shablykov, 2019). The advantage of NMT models is the use of a small amount of memory to perform a full-fledged MT. The built-in recurrent neural network (encoder) resembles the structure of the human brain, encoding the original sentence of the receiving recurrent network (decoder) (Kalinin, 2017). The mixture a new MT type with a static method is considered the most productive way which is believed to produce a high-quality result.

7. Conclusion

The work presents the definitions of three translation systems, i.e. machine translation, computer-aided translation and manual translation. Machine translation is the process of converting written texts from one natural language to another with the help of a special computer program. Its emergence was characterized by the desire of World War II cryptographers and cipher makers to replace human translation work with a computer decoding system.

7.1. Reason for MT widespread appliance

Achieving high-quality results in the transfer of the original meaning has allowed MT systems to win widespread demand among the translation of scientific, technical, journalistic and business texts. The function of the MT is to convey the main essence of the source text, the message of the main information

7.2. Machine translation vs computer-aided and manual translations

MT allows one to optimize the translating processes by a computer system. Computer-aided translation is performed with the usage of machine electronic technology, whereas manual translation is produced only in handwritten form.

7.3. Machine translation as an area of interdisciplinary research

The rapid development of the PC industry has given rise to a large number of MT systems that differ in the technologies implemented in them: 1) MT systems based on grammatical rules (Rule-Based Machine Translation, RBMT); 2) statistical systems MP (Statistical Machine Translation, SMT); 3) hybrid MP systems (Hybrid Machine Translation, HMT); 4) neural systems MP (Neural Machine Translation, NMT). Modern MT systems are developed on the basis of the fourth type of neural networks. Among the well-known Chinese-Russian translation systems are Google Translator, Microsoft Translator, Promt.One, Ultra, PervodSpell, Yandex.Translate, Transër.

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