

Machine Translation Today: Issues and Prospects

Yaseen Alzebaree

College of Languages, Nawroz University, Duhok, Iraq

Corresponding Author: Yaseen Alzebaree, E-mail: yaseen.alzebaree@nawroz.edu.krd

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ABSTRACT

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The main purpose of this research paper is to present a critical and analytical review of literature on machine translation. Machine Translation has come to fill the void existing due to the small number of translators and the impossibility of getting them everywhere. It saves both time and money. A large quantity of articles and documents are easily translated in a short time with a low amount of money but it encounters many problems. However, there are still many issues that machine translations cannot overcome. The cultural specificity of idioms, for instance, remains an obstacle for Google translate. In addition, literary texts lose much of their authenticity when translated by machine. Hence, this review is an attempt to highlight the successes and shortcomings that machine translation has. Despite the technological advancement, it seems that a blended approach to translation remains a viable option for many.

1. Introduction

Technical revolution has led to the development of knowledge fields in general. Human beings dependence on the machine is increasing day by day. Using machine in work has become one of the advanced phenomena, and its absence from work is considered as retardation and poor production phenomenon. Using machines in factories and other places of works has many advantages including speed in achievement, abundance and accuracy. Computer is one of these machines and it is the top product of mankind up to now which is available nearly in all work places, but the area that forms a challenge for this device is the area of language.

In recent years, Machine Translation (MT) has been given special attention and concentration by researchers and scientists due to many factors and reasons, the most important of which is the increasing need of communication between people living in different parts of the world and speaking different languages. The need for machine translation has been felt since the advent of computers, but we can say that the early system attempts of machine translation have proved to be dissatisfactory as, Attia (2002) says that machine translation was based on a primitive idea of processing the source text through an electronic dictionary that included words of the source language and their equivalents in the target language, with no further manipulation either of the input or the output.

The process of translation through the use of machine or computer between human languages is not an easy job or task since human language has a highly complicated system. In spite of the great progresses that the computational linguistics has witnessed, MT is not perfect and is still far from being satisfactorily accomplished and has a long way to go.

There has been a need of translation of information among different languages for thousands of years. Translation requires not only advanced skills in the source and target languages but also knowledge of culture of both languages, especially in the literary translation, as Şenkal (2000) claims that literary translation refers to poetry, drama and other literary works from one language

to another, the ability to choose the correct translation of an element given a variety of factors is vital. By contrast, most of the translations in the world do not contain a high level of literary and cultural knowledge. The majority of professional translators are working on translations of scientific and technical documents, commercial and industrial transactions, legal documentations, instruction manuals, technical and medical text books, industrial patents, news reports, etc.

Furthermore, the demand for language translation has greatly increased in recent years due to increasing cross-regional communication and the need for information exchange. Most materials need to be translated, including scientific and technical documentations, instruction manuals, legal documents, textbooks, publicity leaflets, newspaper reports, etc (Karamat, 2006). It is becoming difficult and impossible for professional translators to meet the increasing demands of translation. Therefore, we see in such a situation that the assistance of computers can be used as a substitute. Machine translation (MT) is an important technology for converting information from one language into another with the help of a computer.

2. Literature Review

Translation is a profession besides being an art. Newmark defines translation as "the attempt to produce approximate equivalence or respectable synonymy between two chunks of different languages on various levels, of which the two main ones are thought and linguistic form." He adds that translation is partly an exercise in the art of writing as well as a field of comparative applied linguistics. Newmark further says that the word, not the sentence, is the essential element of translation. (Hamdalla, 1998: 24) (qtd. in Newmark, 1973)

Methods of translation

For the purpose of understanding the *concept* of machine translation, it is desirable to examine various methods of translation. They are as follow:

Human Translation

Human translation is as old as mankind and the most widely used method. It is also the most reliable method. The other three are considered to be synonymous and are labeled as MT. Some draw a distinction between MAT (also called computer assisted translation) and MT. In MAT, the role of the machine is to assist the human translator, as it is obvious. On the other hand, in the human-aided machine translation, the machine, besides assisting, does the translation as well. The MT is the ideal case that falls in the domain of artificial intelligence (Lehrberger & Bourbeau, 1984: 6-8).

Machine-Assisted Human Translation (MAHT)

MAHT is basically human translation with only limited assistance from the machine. At the lower end of the scale of what might be called "computerized translation" the machine may consist simply of a word processor with provision for looking up translation equivalents of source language words. This may be faster than writing out the translation by hand (or typing it with an ordinary typewriter) and thumbing through a dictionary for unfamiliar terms, but it doesn't remove from the translator the burden of actually performing the translation. Following are some features that may be included in an MAHT system.(ibid)

Human-Assisted Machine Translation (HAMT)

In the case of HAMT, the human translator supplies limited information to "fill out" the machine translation. After being supplied with the necessary data by the translator, the machine completes the translation, producing a raw output suitable for human revision. (ibid)

Fully Automatic (Automated) Machine Translation (FAMT).

In FAMT, there is no human intervention between the input of the original text and the final raw machine output of the translated text. Of course, revision of the raw output may be required, just as it is for the output of a human translator; "fully automatic" does not imply that human post-revision is eliminated. However, there is at least one FAMT system in which the machine itself decides which of the sentences submitted to it are to be revised, all others being translated and considered suitable as finished text ready for use. (ibid)

What Is Machine Translation?

Daxbock (2010: 2) defines MT as a sub-field of computational linguistics, which investigates the use of computers to translate text or speech from one natural language to another. The ultimate goal is to program computers to understand text or speech in source language (SL) like a human does, to create output in target language (TL) that sounds as if it were from a human.

A Brief History of Machine Translation

The idea of using computers to translate or help translate human languages is almost as old as the computer itself (Trujillo A. 1999). There are certain eras that MT has gone through:

Pre-computer: Some of the ideas that have influenced MT were already current or at least existent in the pre-computer era. Since at least the 17th century, scholars and philosophers have proposed the use of language-neutral representations of meaning in order to overcome linguistic barriers.(Mohamed, 2000:18-20)

Initial efforts: Early proposal for the use numerical techniques in MT can be traced at least to 1947, when computers had just been successfully employed in deciphering encryption methods during the Second World War. A memo from Warren Weaver proposed specific strategies for using computers to translate natural languages. This memo initiated MT research in the USA and in the rest of the world, with the first public demonstration of a Russian-English prototype MT system in 1954. This event led to similar work in the then USSR and other places around the world (ibid).

In the 1950s, it was realized how powerful and efficient computers were in performing complex mathematical calculations. This led researchers to believe that computers could also easily be used to translate natural languages. They set out to create such a system and tried to formulate precise rules about lexicon and grammar which the computer would understand. This, however, proved to be much more difficult than they had originally anticipated (ibid).

The development continued, however, and in 1954, MT system was presented at the head office of IBM. The project generated a great deal of public interest but was in fact a very simple system, consisting of 250 words and able to translate 49 selected sentences from Russian into English. This led to increased financial support for the field of MT. (ibid). During the Cold War, a system had been developed in the US, which was used for translations of articles in Russian scientific journals. Although the translations generated by this system were still very rough, it was possible to understand the essence of the articles. If they were deemed interesting from a security perspective, they were forwarded to a translator (ibid).

The Automatic Language Processing Advisory Committee (ALPAC) Report (1966): The initial over-optimism in MT came to an end in the USA when the ALPAC report, commissioned by government sponsors of MT, suggested that MT was not cost-effective.

The 1970s and operational MT: Continued effort in MT yielded operational systems in the early 1970s. Systran began Russian-English translations for US Air Force in 1970, while Meteo began translating weather reports in 1976. Also in 1976, the commission of the European Union (then communities) installed an English-French version of Systran.(ibid)

Rebirth in the early 1980s: The late 1970s and early 1980s saw an increase in interest in MT. The Eurotra project from the European community began in the 1982, influenced by work done at Grenoble and Saabrucken since the

1960s and 1970s. Similarly, in Japan the Mu project started in 1982, and knowledge-based MT started in 1983 in the USA. Some commercial systems also began to appear.

Late 1980s and early 1990s: A number of companies, especially large Japanese electronics manufactures, began to market MT software for workstations.(ibid)

Late 1990s and Machine Assisted Translation MAT: At the end of the decade we saw powerful translation engines on personal computers, translation on the Internet, widespread use of translation memory and translator’s workbenches, multimedia and software localization, as well as an increased interest in Example-based MT (ibid)

Approaches to MT

MT Systems are designed either for two particular languages (bilingual systems) or for more than a single pair of languages (multilingual systems). Bilingual systems may be designed to operate either in only one direction (unidirectional), e.g. from Japanese into English, or in both directions (bidirectional). Multilingual systems are usually intended to be bidirectional; most bilingual systems are unidirectional. (Hutchins, 1995:1).

Three main linguistic approaches to Machine Translation are surveyed, namely direct, transfer, and Interlingua. The objective of this section is to give an overview of what these linguistic methods are, how they work, and what their advantages and disadvantages are (Hui, 1998, p.3). There is another approach which is spoken-language MT.

Direct

In overall system design, there have been three basic types. 'Direct translation' approach is the first (and historically oldest) type. The MT system is designed in all details specifically for one particular pair of languages, e.g. Russian as the language of the original texts, the source language, and English as the language of the translated texts, the target language.(Hutchins, 1995: 2). The direct translation approach to MT is the most basic and least sophisticated one. Dictionary entries are used to translate word by word. (Daxbock, 2010: 3). Processing in MT systems that follow the direct strategy consists of three stages:

1. **Morphological analysis of the source language input text.**

In this stage, the system identified word ending and reduces inflected forms to their uninflected base forms.

1. **Bilingual dictionary lookup.**

Depending on a huge bilingual dictionary, the system decides the correct replacement for source words with equivalent words in the target language.

2. **Local reordering of the target language.**

After the replacement is done, the system makes adjustment to the output text by applying rules for putting words in their right order. The following figure summarizes this process.

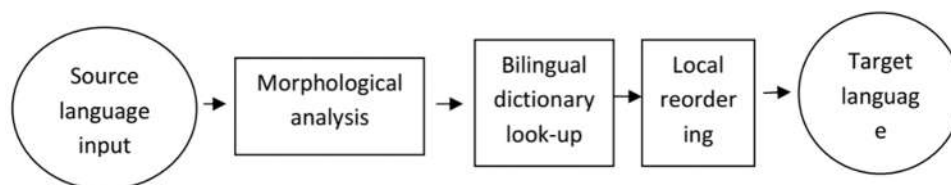


Figure 1: Direct MT System

This approach has advantages and disadvantages. It is easy to implement for bilingual translation because the basic idea is to look up each word in the bilingual dictionary and select a corresponding translation. However, the accuracy is low, because of ambiguity in word meanings and the lack of syntactic knowledge in the system. Furthermore, it is impractical to build a multilingual system based on the direct method. (Hui, 1998: 7).

Despite the clear disadvantages of the direct method, it is still applied to some extent in unidirectional bilingual systems. These systems “take advantage of similarities of structure and vocabulary between source and target languages in order to translate as much as possible according to the direct approach. (Attia, 2002: 13-14).

Transfer

The second basic strategy is the less ambitious transfer approach. Rather than operating in two stages through a single interlingual representation, there are three stages involving underlying (abstract) representations for both SL and TL texts. The first stage converts SL texts into abstract SL-oriented representations; the second stage converts these into equivalent TL-oriented representations; and the third generates the final TL texts. (Hutchins, 1995:2)

The inaccuracy of the direct translation mechanism led to the notion of an intermediate representation of meaning. This idea led to a new approach, called transfer. Although semantics is incorporated into this approach, the representation is still language dependent.

From figure 2 below, we see that both SL and TL require their own analysis module as well as their own generation module. This entails that given SL, we need to analyze it, apply language dependent rules, and generate TL. (Hui, 1998: 3-4)

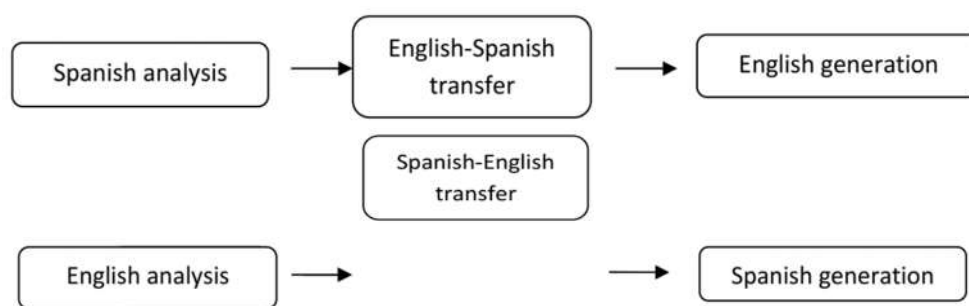


Figure 2: Transfer MT System

The transfer method is a middle course between direct and interlingua MT strategies. The difference between the three strategies can be captured in the following figure:

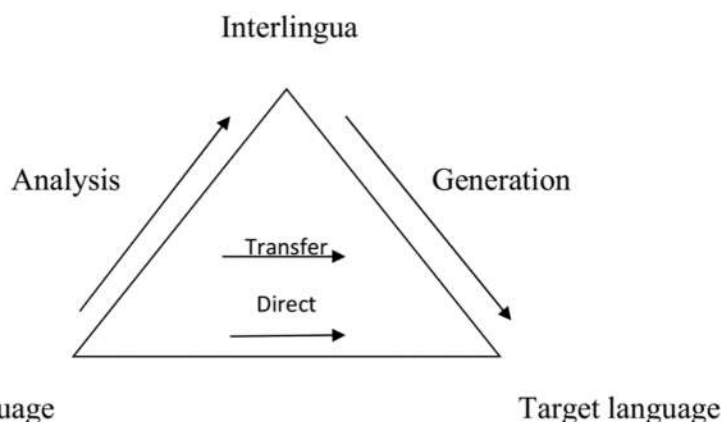


Figure 3: Difference between direct, transfer, and Interlingua MT methods

Interlingua

The third basic design strategy is the Interlingua approach, which assumes that it is possible to convert SL texts into representations common to more than one language. From such interlingual representations texts are generated into other languages. Translation is thus in two stages: from SL to the interlingua (IL) and from the IL to the TL.(Hutchins, 1995:2).

Interlingua is an idealistic approach to solving the machine translation problem because it relies on conceptual representation and linguistic principles. Unlike transfer, the intermediate representation is language independent. This feature makes Interlingua theoretically most attractive because it is the closest technique to arriving at a universal solution. Figure (4) below illustrates the architecture of an Interlingua system. (Hui, 1998:6)

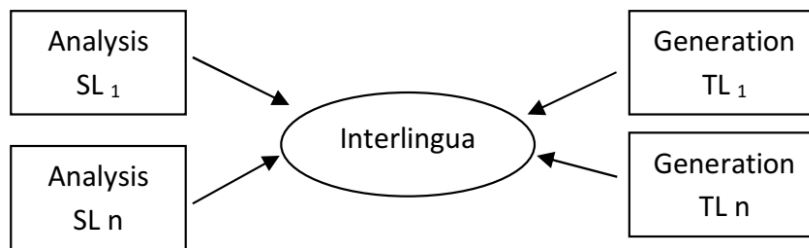


Figure 4: Interlingua MT System

Spoken-language MT

Spoken-language MT is more than a speech-to-text front and backend in a conventional text MT system. Spoken-language is hugely deferent from written language. The basic problem is to isolate the speech signal from the surrounding noise. Other speech related problems are hesitations, self-repairs during speech, accents, mixed language speech, use of anaphora and ellipsis. The dominant form of spoken language MT used to be the translation of dialogues. (Daxbock, 2010:9)

Why does Machine Translation matter?

Human translation cannot cope with the daily massive production of data. It cannot either deal with the technical material and terminology that are used consistently and need to be translated in the same way every day. Consequently, this leads us to envisage machine translation (MT) as probably the only reliable solution. MT is not in itself an independent line of work; it draws from linguistics, computer science, artificial intelligence and translation theory. There is no doubt that Machine Translation has played an important role in transferring information from a language to another and will continue to evolve, given that we are living in a multi-cultural and multi-lingual environment. The existence of MT helps in bringing down the communication barriers.

With the dominance of English over other languages in many fields, it is obvious that more translators are required than before. The amount of translations carried out from English toward other languages is vast and is worth billions of dollars.. The amount of translations carried dollars. The growth of the Internet and the computerization of the worldwide economy have changed the manner business is being conducted, emphasize the call for more efficient and faster techniques of translation, and manage to make use of the huge volume of available data online. (Bessou & Touahria, 2011)

MT is undoubtedly an important topic socially, politically, commercially and scientifically, and intellectually or philosophically. The *social* or *political* importance of MT arises from the socio-political importance of translation in communities where more than one language is generally spoken. Translation is necessary for communication — for ordinary human interaction, and for gathering the information one needs to play a full part in society. Being allowed to express yourself in your own language, and to receive information that directly affects you in the same medium, seems to be an important, if often violated, right. And it is one that depends on the availability of translation. The problem is that the demand for translation in the modern world far outstrips any possible supply. Part of the problem is that there are too few human translators, and that there is a limit on how far their productivity can be increased without automation. In short, it seems as though automation of translation is a social and political necessity for modern societies which do not wish to impose a common language on their members. (Arnold et al., 2001).

This is a point that is often missed by people who live in communities where one language is dominant, and who speak the dominant language. Speakers of English in places like Britain, and the Northern USA are examples. However, even they rapidly come to appreciate it when they visit an area where English is not dominant (for example, Welsh speaking areas of Britain, parts of the USA where the majority language is Spanish, not to mention most other countries in the world). For countries like Canada and Switzerland, and organizations like the European Community and the UN, for whom multilingualism is both a basic principle and a fact of everyday life, the point is obvious. (ibid)

The *commercial* importance of MT is a result of related factors. First, translation itself is commercially important: faced with a choice between a product with an instruction manual in English, and one whose manual is written in Japanese, most English speakers will buy the former. Secondly, translation is expensive. Translation is a highly skilled job, requiring much more than mere knowledge of a number of languages, and in some countries at least, translators' salaries are comparable to other highly trained professionals. (ibid).

Scientifically, MT is interesting, because it is an obvious application and testing ground for many ideas in Computer Science, Artificial Intelligence, and Linguistics, and some of the most important developments in these fields have begun in MT. (ibid)

Philosophically, MT is interesting, because it represents an attempt to automate an activity that can require the full range of human knowledge — that is, for any piece of human knowledge, it is possible to think of a context where the knowledge is required. For example, getting the correct translation of *negatively charged electrons and protons* into French depends on knowing that protons are positively charged, so the interpretation cannot be something like “negatively charged electrons and negatively charged protons”. In this sense, the extent to which one can automate translation is an indication of the extent to which one can automate ‘thinking’ (ibid).

Vagueness

Though seemingly synonymous in common usage, vagueness and ambiguity are entirely different but very important problems in critical thinking. The difference between ambiguity and vagueness is enumerability: an expression is ambiguous if its interpretations can be enumerated as a finite disjunction of potential meanings; an expression is vague if its meaning cannot be given as a finite disjunction of possibilities. Or to put it in simpler terms:

- A word or phrase is said to be ambiguous if it has at least two specific meanings that make sense in context.
- A word or phrase is said to be vague if its meaning is not clear in context (Corr, 2005:8).

Machine Translation Problems

Izwaini (n.d., p. 119-135) states that there are many problems in the output of English into Arabic translation mode. These are divided into lexical and grammatical problems:

Problems of Lexis

The main problems related to lexis in this mode are the lexicon is inadequate and not updated, polysemy and wrong TL word, connotation and collocation. There are also two problems of addition and deletion.

Ambiguity

The relationship between ambiguity and language is both intrinsic and interdependent. The fact is without one we cannot have the other. Ambiguity exists in various levels of seriousness and is one of the features of human language that makes it so unique and complex. Humour, one of the more playful and creative capabilities of language, is based on ambiguity. (Corr, 2005, abstract, 8).

'Ambiguity' is the term for the existence of at least two separate, incompatible interpretations of a stretch of speech. Two kinds of ambiguity are recognized: if it is due to words, it is called 'lexical' ambiguity; if it is due to sentence structure, it is called 'structural' ambiguity. (Strazny, 2005:40).

Lexical Ambiguity

In this chapter, we turn our attention to an issue we set aside earlier: the fact that in different contexts the same word form can be understood to have different semantic interpretation. For instance, a book can mean '**a collection of pages that are bound in a rigid cover**' (hand me that book), '**the information contained in a collection of pages that are bound in a rigid cover**' (that book is depressing) or '**reserve**' (We want to book a table for four). (Murphy, 2010). Lexical ambiguity can be either '**polysemy**' or '**homonymy**'.

Polysemy

The term 'polysemy' is derived from the Greek *poly-* meaning 'many' and *sem* meaning 'sense' or 'meaning'. In its simplest form, then, the term refers to the phenomenon in language where one linguistic form has a number of different, yet related meanings. (Cuyckens & Zawada, 2001, p. x).

Homonymy

Homonyms are unrelated senses of the same phonological word. Some authors distinguish between homographs, senses of the same written word, and homophones, senses of the same spoken word. Here we will generally just use the term homonym. The term homonymy goes back to the Greek word's 'homos', meaning 'the same', and 'onoma', meaning name. A simplified translation of homonymy would be 'having the same name'. (Schulze, 2001).

Multiword Units: Idioms and Collocations

Idiomatic expressions pose a particular challenge for the today's Machine Translation systems, because their translation mostly does not result literally, but logically (Anastasiou, 2010: abstract).

A collocation is an expression whose meaning cannot be worked out from the meanings of its constituent words. Even if you know the meanings of all the words in the phrase **let the cat out of the bag**, you cannot guess the idiomatic meaning of the whole expression: this you must learn separately. (It means, of course, to reveal something publicly which is supposed to be a secret.) (Trask, 2007:114).

The translation of collocations is difficult for non-native speakers of a language. Differences in the collocational patterning of the source and target languages create potential pitfalls and can pose various problems in translation. The difficulty for the learner is not to recognize a source language collocation but to find an acceptable target language equivalent.

The translation of collocations is an ever-lasting struggle for learners of English to match the proper noun with the proper verb or adjective. The problem is that language is not made up of a large number of words that can be used together in free variation; words have a certain tolerance of compatibility. Like individual words, collocational patterns carry meaning and can be culture-specific; this in addition to their largely arbitrary nature, gives rise to numerous problems in translation. (Boussalia, 2010)

Acronyms

Words made up of initial letters are known as acronyms, of which well-known examples are NATO (for North Atlantic Treaty Organization), RAM (for Random Access Memory), and AIDS (from Acquired Immune Deficiency Syndrome). Intermediate between an acronym and a blend is sonar (from Sound Navigation and Ranging). (McCarthy, 2002:65)

Structural Ambiguity (syntax problems)

Structural ambiguity occurs when a phrase or sentence has more than one underlying structure. The main problems related to grammar and syntax in the English Arabic mode are word order, gender, reference, tense and aspect, prepositions, the definite article, and wrong analysis of grammatical categories. (Izwaini, n.d.:119-135)

Currently machine translation (Google Translation) is probably the most important field of computational linguistics. Machine translation has begun to become an indispensable tool for many users, and its significance is dramatically increasing day by day. MT has been given more interest recently due to different reasons such as: information revolution, advance in telecommunication and other fields of everyday life, huge amount of data that need to be translated in time that it is impossible to get human translator or the shortage in the number of qualified translators.

The obstacles to translating by means of the computer are primarily linguistic. To overcome them it is necessary to resolve the ambiguities that pervade a natural language when words and sentences are viewed in isolation. Texts are normally not ambiguous to their readers; the challenge for researchers is to develop computer programs with something like the ability of the ordinary human reader to extract the intended meaning from the string of words that forms a text. To put the matter another way, the computer must be taught to understand the text- a problem in artificial intelligence. (Lehrberger & Bourbeau, 1984).

As laid out at the beginning of this paper, the objective of this research is to investigate problems and challenges faced by machine translation (Google), mainly lexical and structural ones from and into English and to help scientists to develop MT systems.

Based on the analysis of the obtained data in this study, the researcher has come up with the following conclusions:

3. Methodology

This study is review of existing literature about machine translation. Previous studies are incorporated in this study. Characteristics of machine translation are also explained with reference to certain issues pertinent to the field. The study relies heavily on collected published studies in several journals.

4. Results and Discussion

This section is a comparative or descriptive analysis of the study based on the study results, previously literature, etc. The results should be offered in a logical sequence, given the most important findings first and addressing the stated objectives. The author should deal only with new or important aspects of the results obtained. The relevance of the findings in the context of existing literature or contemporary practice should be addressed.

Although MT has been progressed and given attention recently by scientists and programmers, there is still a long way to go forward as it is still defective in comparison with the human translation and there is a lot that we can do to improve the quality of

MT output and increase its usefulness. MT (Google) sometimes translates texts that can't be understandable unless one has previous knowledge on that text and it has not been able to deliver fully automated high-quality translations. MT is not accurate. It has been proved that MT has lexical and structural problems related to: deletion, Non-vocalization, homographs, collocations, acronyms, wrong word order, subject-verb agreement, passive voice ...etc. Some words either remained untranslated, or deleted in MT (Google System).

5. Conclusion

The study aimed at presenting an overview of the problems associated with machine translation. The analysis reveals that machine translation has become unavoidable, yet it has certain shortcomings. According to the findings of the study, the researcher has the following recommendations which programmers and scientists can take into consideration:

1. Programmers and scientists are recommended to build up a system of MT that can share a syntax and morphology (grammar) of different languages particularly those that belong to different families.
2. More effort must be given to improve the quality and accuracy of MT output.
3. It is recommended to input every new word in the MT lexicon.
4. Programmers and scientists should establish a system that can address the problem acronyms.
5. Programmers and scientists have to pay more attention and give more emphasis to the output problem of collocations.

Suggestions for Further Studies

In light of the findings of the study, the researcher suggests the following:

1. Further work needs to be done to establish a system of MT that includes syntax, morphology and semantics of different languages particularly those languages that belong to different families.
2. More researches should be carried out to improve machine translation systems from and into English language.
3. It is suggested that further research should be undertaken in addressing problem of acronyms.
4. Further research regarding collocations problem would be of great help.
5. The researcher suggests carrying out researches on passive voice problems in Machine translation between English and Arabic.
6. Adopting researches on challenges of prepositions facing MT.

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