Evaluation of Google Image Translate in Rendering Arabic Signage into English

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Abstract

When people travel to another country for work or leisure, they regularly need a medium to help them understand the written messages in other languages. *Google Translate* offers a new service: translating the content of images (texts) instantly and freely into 100 languages powered by the Neural Machine Translation approach (NMT). In this vein, the current research paper attempts to evaluate the accuracy of *Google Image Translate* service in rendering the texts printed on Arabic signage: banners and road and shop signs from Arabic into English. Besides, it aims to identify the capacity of *Google Translate* in rendering Arabic signage into English effectively without the help of human translators. The paper adopts the Linguistic Error Analysis Framework of Costa et al. (2015) in analyzing the output of Google image service in terms of orthography, grammar, lexis, and semantics. The paper shows that *Google Translate* made the following errors while rendering the content of images into English: mistranslation, omission, additions, wrong choice, misordering, subject-verb disagreement, and semantic errors. In conclusion, the *Google Image Translate service* helps the users configure the gist of the image. However, a human translator is still needed since MT may not provide an adequate and effective translation as humans do.

Keywords: Google image translation, Arabic signage, machine translation, banners translation, English and Arabic translation, translation studies

1. Introduction

Translation applications have increasingly developed in a sophisticated way over the years and can exceptionally be very helpful in traveling overseas. Translation applications can aid travelers when they visit other countries. Most translation applications require an internet connection while the others work partially or entirely offline. Nine most popular translation applications can be used when traveling abroad: *iTranslate, Google Translate, TripLingo, Say Hi, Papago, Microsoft Translator, Waygo, iTranslate Voice, and Speak Translate*. Some of these applications offer a free service while others require payment to utilize the service. These applications provide different translation services, including voice translation, words for words, texts, and image translation (Zaino, 2020). The present paper selects *Google Translate* due to its popularity and free service for more than 100 languages, including Arabic.

The demand for human translators has been increasing considerably in various fields of knowledge: scientific, legal, technical, economic, social, business, administrative, political, and medical. The growth in translation demand is beyond the capacity of human translators, and there should be a means to cope with the considerable demand for translators. Therefore, scientists have thought of integrating translation with technology to keep pace with the recent advances of science. The integration of technology and translation has led to a new machine translation (MT) discipline.

1.1 Machine Translation

The early insights on using machine translation were in France and Russia in 1933. Georges Artsrouni, a French scientist, proposed a method for meaning retrieval based on a paper tape. For Petrovič, Trojanskij, a Russian Scientist, proposed a device that translates across languages based on three translation processes: analysis, transfer, and synthesis. However, Trojanski's proposal was not successful since he did not provide full explanations of the three

processes (Almahasees, 2020; Almahasees et al., 2021)

In 1950, Warren Weaver started thinking about the possibility of using the newly invented computer, Electrical Numerical Integrator Computer (ENIAC), in translation. In his memorandum of translation, he explained that the linguistic coding of cryptography might be a helpful tool in translation (Almahasees & Jaccomard, 2020) (Schwartz, 2018). In 1954, the first MT experiment was conducted, collaborating with Georgetown-IBM to translate English and Russian. The experiment succeeded in translating 250 words from Russian into English. The success of the first experiment attracted a lot of attention to the potentiality of MT and a large scale of funding to sponsor MT research. Following the success, the Automatic Language Processing Advisory Committee (ALPAC) was formed by the USA government in1962 to assess MT research and the feasibility of MT. In 1966, the committee issued a report, and it concluded that there were no prospects of MT. As a result, MT research halted temporarily in the USA till 1980, except for some MT research in Canada and French to translate metrological information using machines. The revival of MT started in 1980 by providing free and paid translation services after the invention of the Internet in 1990 (Hutchins & Somers, 1992). Nowadays, several online platforms offer free translation or paid services, such as *Microsoft Translator, Bing Translator, Google Translate*, and many others. The current paper is confined to MT systems that offer Arabic into English translation and vice versa, which are 56 as indicated by (Hutchins, 2010).

MT services provide an instant translation for vast swathes of texts quickly. (Hutchins, 2010) compiles a compendium of MT systems in the world. He indicates that the number of English<>Arabic translations is 56, including *Microsoft Translator, Sakhr, Google Translate, Bing Translator, Reverso, Babylon*, and many others. The given systems differ in prominence and the number of offered languages. In this respect, *Microsoft Translator* provides translation services for 70 languages; *Google Translate* for 103; *Bing Translator* for 70; *Reverso* for 15; *Babylon* for 77; *and Sakhr* for two languages. MT system, in general, provides translation services at the level of words, documents, and websites. However, the offered services are different from one system to another. Some of the systems use different MT approaches. Moreover, some systems require paid subscriptions; therefore, end users' preferences are varied too.

1.2 Image Translation

Image translation resorts to a technology where the end users can render the text on images or pictures extracted from printed texts (documents, screenshots, signboards, menu lists, banners, and posters). It has gained wide popularity and benefited language translation globally for the end-users in the last decade. Image translation is considered a recently developed domain. The Japanese first introduced it in 2004 to manufacture a mobile phone with a camera to take a photo and translate it into another image (Koga et al., 2005). WPML Media Translation designed a tool that allows end-users to upload pictures and get their photos translated into all languages (Amir, 2020). Translating texts from images will enable end-users to travel abroad with confidence that they have a tool to help them to translate instructions at train stations, food descriptions, signs, brochures, and banners. *Google Translate* can tremendously help (Morina, 2018).

Image translation services are powered by optical character recognition (OCR) to extract any text involved in an image to translate it into another language. OCR is the transference of scanned images of printed and written texts. Eyes and brains always observe it. It allows the end-users to convert various documents into editable and searchable records, such as scanned paper documents, PDF files, or digital camera images (Jana et al., 2014). OCR deals with the image as an input and translates the image as an output. The OCR system essentially relies on four categories: pre-processing, features extraction, features training, and features matching. They are pre-processing analyses of the input images to improve the opportunities of recognizing images successfully. Features extraction identifies and extracts the most critical details from the text image. Features training is used to recognize the extracted characters contained in the image. Finally, feature matching matches the extracted features with trained features to provide the translation of the image.

1.3 The Selected System for the Study

The paper adopts *Google Translate* as its system due to its wide use, comprehensive MT services, and prominence as the first system globally. Furthermore, *Google Translate* is considered the most prominent MT system since it offers free translation services in 100 languages with more than 500 million daily users (Almahasees, 2020, Almahasees et al,. 2021). It provides translation services for texts, documents, websites, speech to speech, image translation, and handwriting or virtual translation.

1.3.1 *Google Translate* Image Application

Google Translate has an application available on Android and App store. Each mobile device has a camera resolution

of 2 megapixels or above with an auto-focus ability to download it for free. Uploading the *Google Translate* application to the device allows you to use the camera and conversation translation services provided, as shown in Figure 1.

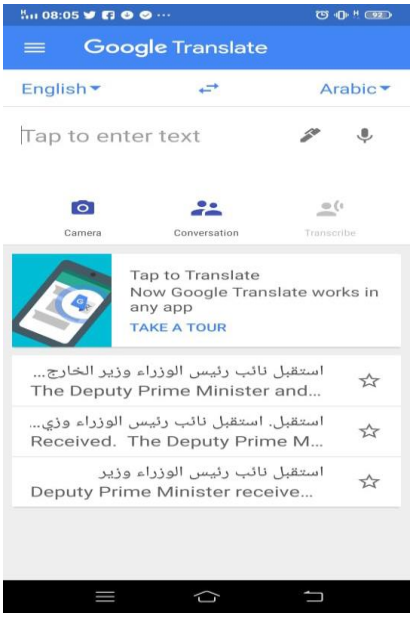


Figure 1. Google Translate (Google Translate, 2021)

The above figure shows that MT services are provided by *Google Translate* at the level of words, sentences, documents, voice, conversation translation (speech to speech), translation transcribe, and image translation through a camera. Image translation can be done through the application by the following steps:

1. First, install the translate application on your Android cell phone or tablet
2. Choose the source and target languages
3. Beneath the text box, choose the camera.
4. Shot a new photo or use the photos available on your cell phone.
5. Finally, get the translation of the chosen image texts in your preferred target language.

1.4 MT Evaluation Methods

Evaluation of MT systems is an essential area of research, both for assessing the effectiveness of existing MT systems and improving MT systems' performance (Dorr et al., 2011). Several evaluation methods of MT have been used over the phase of Machine Translation Evaluation (MTE). MTE aims to verify the capacity of MT systems to provide feedback about the limitations and strengths of MT systems. Evaluation of the system is considered essential for designing and improving the system. Chan (2014) indicates that there are two main methods of MT systems: manual and automatic. Automatic evaluation includes using automated metrics to assess MT output without human intervention in run-time. The manual evaluation depends on human evaluators to verify the quality of MT outputs.

Automatic evaluation is usually described as objective, consistent and unbiased while manual evaluation is subjective. Human judgments are prone to personal bias and inconsistencies. Automatic evaluation is done without human interventions through text similarity metrics such as Bilingual Evaluation Understudy (BLEU). On the other hand, manual assessment of MT is usually done through post-editing, a comprehension test, error analysis, and translation ranking. Even though the manual evaluation is typically inconsistent and subjective, it cannot be nullified by any automatic metrics since they usually look for text similarity between the referenced translation and MT output. TAUS (2019) [14] shows that "Automatic MT quality metrics offer only one side of the story about quality, which is not always useful in a production environment." Similarly, Callison-Burch et al. (2006) indicate that automatic metrics are not a perfect substitute for the human translation quality evaluation.

While automatic evaluations are objective, quick, and unbiased, they are not substitutes for human assessment of MT. Several manual evaluation metrics have been suggested: adequacy, fluency, post-editing, and error analysis. Adequacy assesses the meaning transference of ST into TT. Fluency evaluates if the TT conforms with TL rules or not. Post-editing measures the need to edit the output of MT systems. Finally, error analysis evaluates the output and sheds light on the main errors made for systems improvement. The research lies under the manual evaluation umbrella, and therefore the paper adopts Costa et al.'s (2015) framework of error analysis.

1.4.1 Error Analysis

Although error analysis is used to identify second language errors, it can assess MT outputs. Several Error frameworks have been proposed to classify MT errors. Vilar et al. (2007) propose a five-item classification to split MT errors into missing words, word order, incorrect words, unknown words, and punctuation errors. (Bojar (2011) was influenced by (Vilar et al., 2007) classifying MT errors. He divides Villar's taxonomy into insufficient punctuation, missing words, word order, and incorrect words. He adopts Villar's framework, but he eliminates unknown words type. It is evident that the previous researchers focused on evaluating punctuation, grammar, and lexis, but they neglected the importance of semantics and discourse in texts. In this regard, (Costa et al., 2015) proposes a comprehensive and systematic framework that links between human error taxonomies and MT error typologies, as shown in figure 2

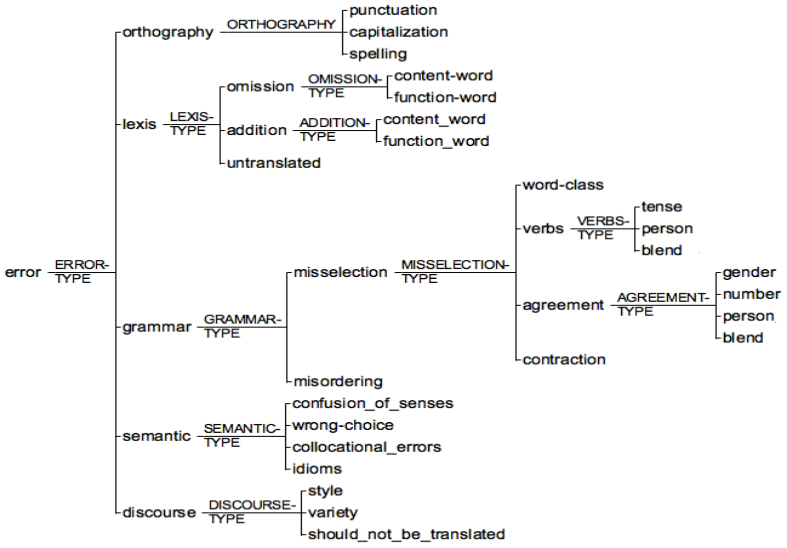


Figure 2. Error Taxonomy

Costa et al. (2015) classify error analysis into orthography, lexis, grammar, semantics, and style. Orthography refers to the rules of punctuation, spelling, and capitalization errors. Lexis is concerned with the way of translating words. Lexis errors include omission, addition, and untranslated words. They inhibit the intelligibility of the translated text and present it inadequate. Grammar refers to the syntactic features of the language. In grammar, the main errors are misordering and midsection (tense and gender agreement). Semantic errors refer to the meaning of the words. There are two main errors in the semantic section: wrong choice and confusion of senses. Wrong choice resorts to using one of the possible meanings but not the right choice for the word. Confusion of senses refers to the wrong choice that confuses end-users and makes the text unintelligible. The research paper will adopt lexis, grammar, and semantic error categories in analyzing the system's output selected for the research paper.

2. Literature Review

MT has significantly been studied in English. However, a small number of surveys and research publications were conducted in Arabic Machine Translation (AMT). AMT requires massively coordinated and organized research to catch up with other languages. This reflects the gap for AMT and the need for collaborative research and public access to language resources to enhance the state of AMT (Elsherif & Soomro, 2017). During the last decade, new MT programs have been proposed and applied to improve the process for MT between English and Arabic. Zakraoui et al. (2020) indicate that many MT systems offer Arabic translation; however, its translation quality needs to be

enhanced. Abid & Mourri (2018) review different MT approaches to Arabic to English translation. They reveal that Neural Machine Translation (NMT) systems outperform other MT approaches.

Moreover, integrating an attention-based approach with NMT could enhance the process of MT across languages. He builds a new MT approach of NMT Transformers to translate English into Arabic. They show that their new program could provide an accuracy of 84%. Shquier & Alhawiti (2017) designed an Arabic-English Transfer-Based Machine Translation (AE-TBMT) system and tested its efficiency. They conclude that their system accurately handles Arabic texts with the highest percentage of 96.6%. (Zaghouani et al., 2016) built a corpus for Arabic that enhances the process of human post-editing for MT output. They show that their designated corpus is a breakthrough to date for this language pair since it facilitates post-editing service for the translated texts.

Several MT studies have been conducted on the central MT systems in English and Arabic; Al-Abbas et al., 2020; Al-Abbas and Haider, 2020; Huessin & Hiader, 2020; Saed et al., 2022) Matsuzaki et al. (2016) evaluate the output of three MT systems: Google Translate, Yahoo, and NICT, the Japanese system. Seven hundred ninety-five human participants assessed the output of the three systems. They found out that the frequent translation errors were as follows: missing words, wrong choice, the literal translation of idioms, and grammatical errors. (Abu-Ayyash, 2017) analyses the English-Arabic errors in translating gender-related structures by the three MT systems: Systran, Google Translate, and Microsoft Bing. He claims that the three systems have a subject-verb agreement and adjectival-noun one due to the disparity between English and Arabic regarding subject-verb agreement and gender. Moreover, the three systems render pronouns inconsistently, although the subject pronoun is similar in English and Arabic. (Almahasees 2017) evaluates the strength of Statistical Machine Translation (SMT) in handling political texts from Arabic into English. Analyzing the capacity of Google Translate and Microsoft Bing in rendering Arabic political texts into English through Automatic evaluation metric BLEU, he shows that Google outperforms Microsoft Bing in political domains. (Almahasees, 2018) evaluates Google Translate and Microsoft Bing with NMT in rendering printed-media reports from Arabic into English. Analyzing his corpus using error analysis, he reveals that NMT enhances the process of MT in comparison with the previous MT approach, SMT. (Almahasees, 2020) diachronically compares the efficiency of Google Translate, Microsoft Translator, and Sakhr. Shedding light on different MT approaches and their roles in Arabic<>English translation, he finds out that Google Translate outperforms the other systems. The NMT approach significantly improves English<>Arabic better than SMT and Hybrid MT.

The literature reviewed above shows that image translation has not been meticulously and thoroughly investigated in all languages. Consequently, there is no systematic study to verify the accuracy of the Google Translate image service. To the authors' best knowledge, this research paper is the first one investigating Google image translation in terms of error analysis from Arabic into English.

3. Methodology

The current study is qualitative, as the researcher will analyze the output of Google Image Translate Service in dealing with Arabic signs into English. The corpus of the research paper was collected from different locations where banners, shop signs, and road signs are meant to provide necessary information to the end-users. In addition, the images were taken from hospitals, clinics, and highway roads. Therefore, the current paper aims to assess and verify Google Translate's accuracy in rendering texts on images from Arabic into English for the end-users. Analysis in this research paper relies on Costa et al.'s (2015) taxonomy of error analysis in highlighting the capacity of image translation provided by Google Translate. Furthermore, the paper adopts the error analysis method (see Figure 2) to analyze the recurrent errors made by Google Image Translate.

4. Analysis and Discussion

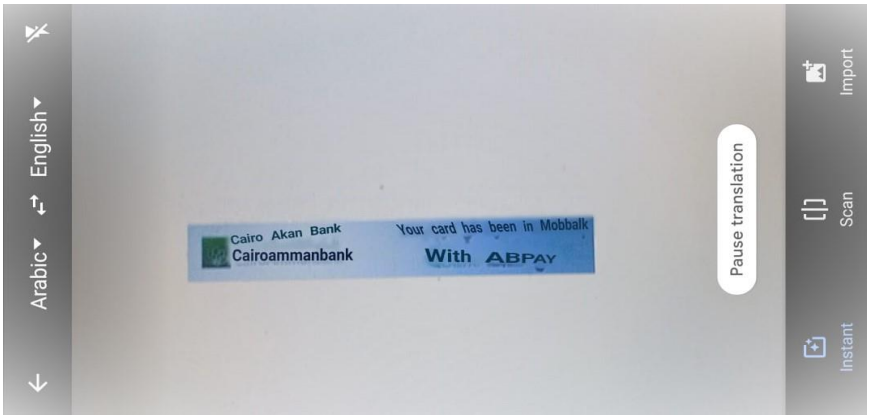
The following analyzed image texts are examples of online advertising banners, health safety signs, roadside banners, tourism advertising banners, hospital advertising signs, real states signs, medical clinic signs, and shop signs in sequence.

4.1 Online Advertising Banners

Advertising banners are usually located in front of shopping centers, supermarkets, exhibitions for advertising goods or services. Currently, online advertising is used for the same purpose. It can be seen, and when clicked, it leads to the advertising company's website. The following banner is extracted from Ammon Website (Ammon News Agency, 2021).

Source Image:

Google Image Translate:



The ST text presents an advertisement by the Cairo Amman Bank of Jordan for customers. The content on the image shows a new service offered for customers. The ST text is

بطاقتك صارت في موبايلك مع خدمة CABPAY

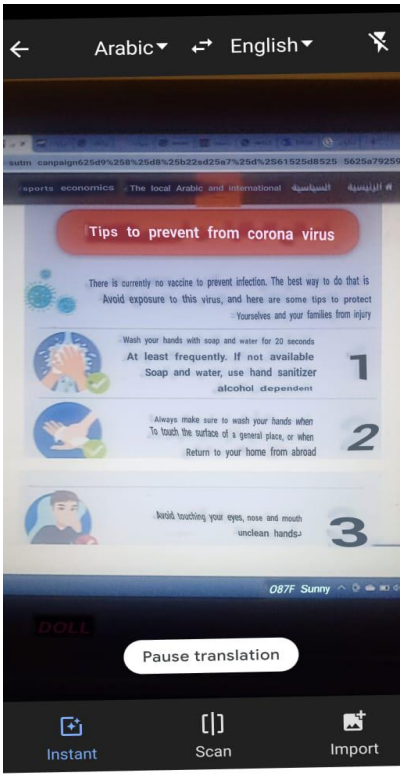
The Google Image translate renders the ST text on the image as "your card has been in Mobbalk with ABPAY." This translation shows that Google Translate made semantic errors: confused senses and wrong translation. The translation here confuses the readers since the translation is not precise, such as the word 'Mobbalk.' Moreover, the bank's name has been mistranslated as 'Cairo Akan Bank.' The translation should be Cairo Amman Bank. Such errors inhibit the intelligibility of the text and present a text that is too difficult to understand. Moreover, the system misinterprets the abbreviation of CABPAY as ABPAY, which does not represent the ST text correctly. Such errors are critical since they present different messages and deform the ST.

4.2 Health Safety Signs

A health safety sign is a compelling reminder to people to take necessary steps to prevent the spread of an outbreak or to inform them how to put their health first. For example, during the COVID-19 pandemic, safety banners were placed in different locations to remind people of the dangers of COVID-19 constantly. The following extracted safety banner has been issued by the Ministry of Health in Iraq (Ammon News Agency, 2021).

ST image

Google Translate Image



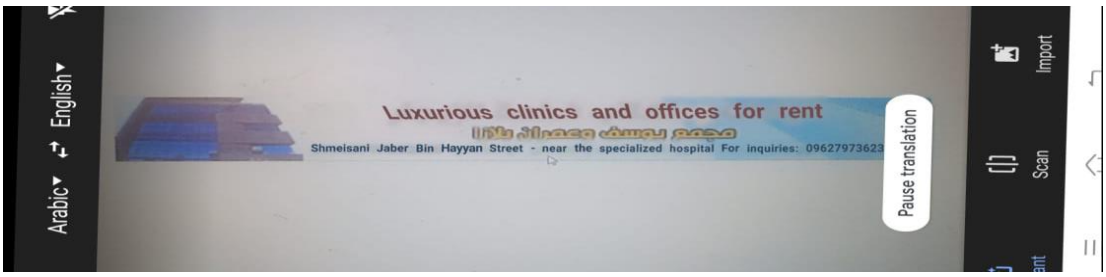
The above image shows that Google's image literally and incorrectly translates the informative banner. The system here literally translated the ST phrase "*المعتمد على الكحول*" into "dependent." This represents a wrong choice of the correct equivalent since the word "dependent" means "one who relies on others and is not independent." In addition, *المعتمد على الكحول* means that the sanitizer is based on Alcohol. Therefore, the correct translation is "Alcohol-based sanitizer." Moreover, the system does another word choice error in rendering the Arabic noun "*الإصابة*" into "injury." The noun "injury" implies physical harm or damage to the body. At the same time, the ST text indicates a disease by bacteria or a virus. Thus, the correct equivalent should be "infection."

4.3 Roadside Banners

Some companies use roadside banners to offer their products for sale, investment, and lease. These banners are designed for pedestrians and drivers. The following example was taken from a banner showing renting, investing, and selling offices in a commercial complex in Amman.

Source Text Banner:

Google Image Translate:



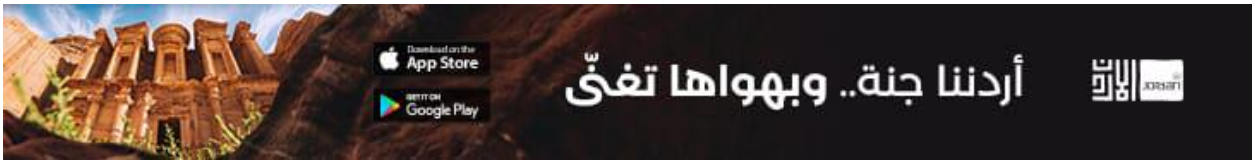
The translation here indicates that the selected system here has successfully translated most of the banner content. However, the system has kept the name of the commercial complex untranslated, which leaves the reader confused about the place offering to lease luxurious clinics and offices. Therefore, the correct translation for the above banner should include "Yousef and Imran Plaza Complex" to be fully adequate and clear to the end-users.

4.4 Tourism Advertising Banners

Governmental and Travel Agencies worldwide use tourism advertising banners to attract new tourists

to famous tourist places. The Jordanian Board of Tourism issued the chosen banner in Amman to attract tourists to visit Jordan.

Source Text Image



Google Image Translate

Google Translate here translates the advertising banner as "We wanted paradise. And she fulfills her desires". Such translation does not translate the ST text since it renders it. It offers wrong translations of the ST. The output indicates that people are looking for a paradise that still fulfills their desires. Such output does not specify the location of paradise, while the ST describes Jordan as a paradise for vacations. The correct translation should be 'Jordan is a paradise which always mesmerizes.

4.5 Hospital Advertising Signs

Hospitals use advertising signs to indicate their locations, working hours, available specialties, and departments. The chosen sign is placed in front of Al-Najah Hospital. The advertising sign illustrates the specialty of the hospital in Obstetrics and Gynecology Diseases.

ST Image:

Google Image Output

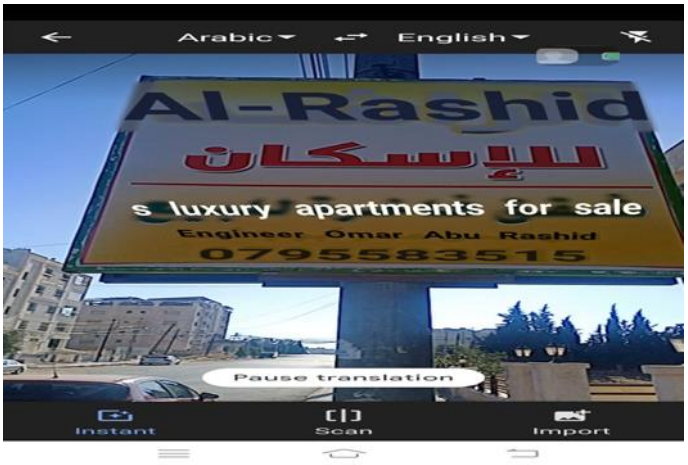
Google Translate here does a wrong word order in imitating the SL word order "مستشفى نجاح, which is different from

the correct TL "Najah Hospital." Moreover, the system mistranslated the specialty of the hospital in rendering ولادة وأمراض نسائية" " as "Birth and Gynecological diseases. " In contrast, the appropriate name of the hospital specialty is "Obstetrics and Gynecology Diseases". Moreover, there is no need to the word "surgery" because it is implied in the specialty.

4.6 Real States Signs

Real states Agencies use road signs to promote their advertisements in selling and leasing properties. The chosen sign is taken from a company in the northern part of Jordan, specializing in selling luxurious apartments.

Source Image: Google Image Output"

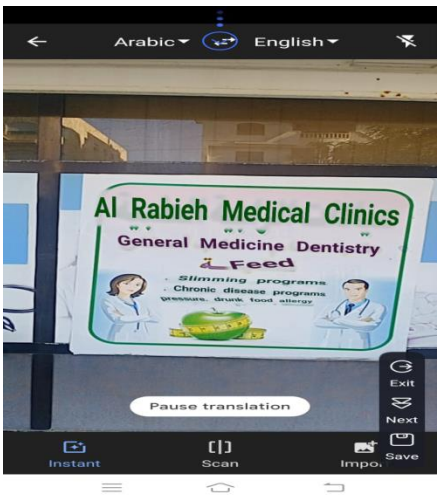


The real state sign promotes selling luxurious apartments in the northern city of Jordan, Irbid. The sign consists of the surname of the housing company, the type of apartments, and the company's contact details. Google succeeds in rendering the surname of the owner of the company, "Al-Rashid." However, the field of the company was untranslated, "للإسكان" The noun للإسكان' should be rendered as "for Housing." Moreover, the housing company's description has been translated correctly. In addition, the owner's full name has been adequately translated along with the company's phone number.

4.7 Medical Clinic Signs

Medical clinic signs are placed in front of medical clinics. Such signs include information about the available specialties in the clinics in Irbid, Jordan. The extracted sign is from Al-Rabieh Medical Clinics, specializing in General Medicine, Dentistry, and Nutrition.

Source Image Google Output Image



Google Translate renders the name of the clinic and specialties correctly except the specialty "بتغذية" However, the system under study incorrectly translated the noun تغذية" as "feed." Such an error inhibits intelligibility and presents

the partial meaning of the ST. The proper translation is "Nutrition." However, the system translates the programs of nutrition correctly except سكري.

Moreover, it translates سكري as 'drunk,' which is wrong. The system here identifies "سكري" in Arabic with "drunk" since they are written similarly, but their meanings are different. The correct translation here is "Diabetes." This error indicates that the system can still not relate the words with their context. Moreover, the system omitted زيادة الوزن in its translation into English, which deters the meaning of the context. The correct translation of زيادة الوزن should be "weight gain."

Shop Signs

Shop signs are the perfect way to promote businesses and show the available products. The collected photos are from fruit and vegetable shops.

ST Image

Google Image Translate

This advertised sign is placed in front of a fruit and vegetable store. The store's name is Abu Al-Abas for all customers (people), and the purpose is to sell fruit and vegetables. Unfortunately, the system incorrectly translates the shop's name, Abu Al-Abas, for all customers (people); it translates it as UAI and Play, which does not make any sense. This error means that Google cannot render all Arab nicknames if the systems do not deal with them before. Moreover, the sign's purpose has been translated partially, where the system translates one part correctly and commits the wrong choice in the other part. For example, the shop aims to sell vegetables and fruit while the system translates it as 'cucumber and fruits.' The correct translation for the shop's purpose should be "Vegetables and Fruit."

4.8 Clothes Shops

Example 2:

ST Image:

Google Image Output

The shop sign advertises selling European clothes for women, young ladies, and kids. The sign consists of the name of the shop, types of clothes, and the shop's contact details. However, the system did not succeed in rendering the image into English. It kept the sign untranslated except the noun 'my daughter.' The system renders one-word بناتي" into English as "my daughter," which is considered a wrong choice. The correct translation of the image is

"Affordable Boutique for European Clothes."

5. Discussion

The research paper reveals that Google Translate committed errors while translating images of banners, road signs, and shops signs from Arabic into English. One of the significant errors is keeping the words untranslated. This error is caused by the inability of the system to identify the words since the system is not trained on such words. Moreover, the system is not able to locate the vernacular words. Such an error inhibits the intelligibility of the text and leaves the end user confused. On the other hand, the selected system committed wrong choice errors where the system chooses the wrong word without a clear relation to the ST word. Moreover, the main grammatical errors committed by the selected system were word order, tense and person, errors of agreement (pronoun agreement), and also preposition and article errors. Even though the selected system has committed several errors, it sometimes helps configure the sign's meaning. Figure (3) below outlines the main errors committed by the selected system while rendering Arabic signs from Arabic into English.

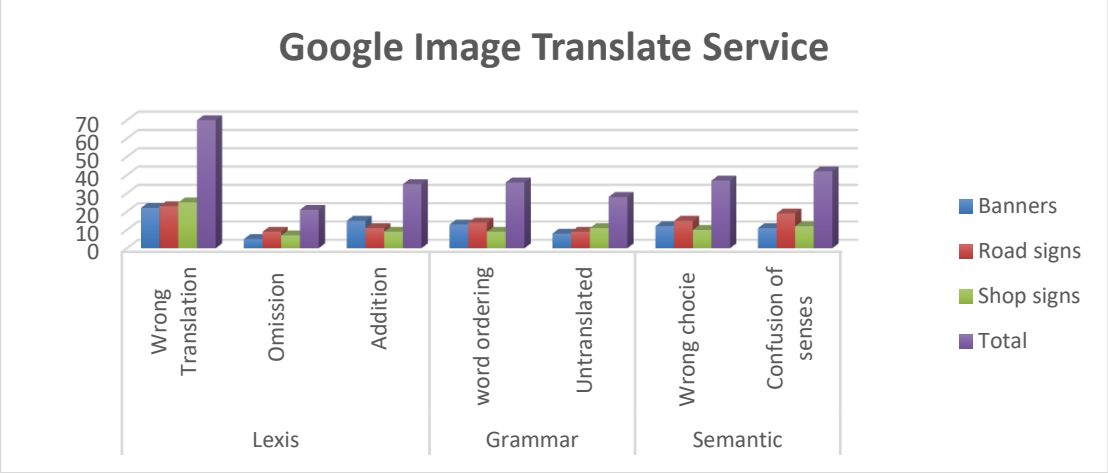


Figure 3. Google Image Translate service in rendering Arabic texts on images into English

The system made the highest number of errors, equal to 70, in incorrectly translating the content of images into English. Semantic errors revolve around providing an output that confuses the readers, equal to 70 errors; 37 wrong choice errors; word order errors, 36 and 35 addition errors. The system made 28 pronoun agreements and then omitted 21 as the lowest number of errors.

6. Conclusion

Google Translate is making impressive improvements in translation services. The image translation service is offered for more than 100 languages, considered a breakthrough in our lifetime. MT has gained great attention. However, most of the research on image translation was conducted by computer scientists conversant with image synthesis, segmentation, restoration, and processing. On the other hand, image translation has not been meticulously and thoroughly investigated in all languages. There is a lack of research on translation scholars' accuracy of translated texts in photos. There is no systematic study to verify the accuracy of the Google Translate image service. To the authors' best knowledge, this research paper is the first one investigating Google image translation in terms of error analysis from Arabic into English.

The paper shows that the system made the highest number of errors in providing the wrong translation for the ST text, followed by the confusion of senses and wrong choice errors. Moreover, the system made addition and omission errors. The current paper concludes and reflects the following research perspective: the authors believe that Google Translate saves time and effort. It works as an aid, but it will never replace human translators. For further research, the paper proposes to extend such a scope to include other types of texts, including images, so that the validity of the paper findings can be generalized.

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