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Google Translate Arabic to French Accuracy

دراسة دقة ترجمة جوجل من العربية الى الفرنسية

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Abstract :

By looking at the development of Artificial Intelligence (AI) and the simulation of the human mind in its dealings with linguistic communication, it is not excluded that Neural Machine Translation (NMT) replaces Human Translator (HT) in the world of Interactive Communication (IC). This raises the question of whether neural machine translation (NMT) replaces Human Translation after it has achieved a remarkable development than statistical machine translation (SMT). For this purpose, the present study aims to evaluate the quality and performance of Arabic to French G-NMT output through a descriptive qualitative and quantitative analysis of adequacy and fluency depending on the Human Translation Reference (HTR). Our results indicate that the adequacy and fluency of Google translate the output from French into Arabic are of acceptable quality, but Human Translator (HT)is not getting replaced, so further research is needed to complement the findings of the current one in different types of texts as well as indifferent pair of languages.

Keywords: Artificial Intelligence (AI), Neural Machine Translation (NMT), Arabic-French, Google translate Accuracy, Human Translation Reference (HTR).

ملخص:

نظرا لما حققه الذكاء الاصطناعي من تطور ومحاكاة للعقل البشري في تعاطيه مع التواصل اللغوي، لا يُستبعد أن تحل الترجمة الآلية العصبية التفاعلية محل الترجمة البشرية في عالم التواصل التفاعلي. وهذا ما يدعونا لتساؤل عما ان كانت الترجمة الآلية العصبية ستحل محل الترجمة البشرية، بعدما حققته الترجمة الآلية العصبية من تطور ملحوظ مقارنة بالترجمة الآلية الإحصائية (SMT). وعليه تسعى هذه الدراسة لتقييم دقة وجودة مخرجات ترجمةجوجل من العربية إلى الفرنسية، من خلال تحليل وصفي نوعي وكمي، لمدى كفاية وطلاقة ترجمة جوجل قياسا بالترجمة البشرية. وخلصت الدراسة إلى أن كفاية وطلاقة خدمة ترجمة جوجل من الفرنسية إلى العربية ذات جودة مقبولة، ولكنها ابعد من ان تحل محل المترجم البشري، ما يفتح الباب واسعا امام مزيد من الدراسات على نصوص وثنائيات لغوية مختلفة لتطوير ادائها.

كلمات مفتاحية: الذكاء الاصطناعي (AI)، الترجمة التفاعلية العصبية (NMT)، دقة خدمة ترجمة جوجل، عربي فرنسي، مرجع الترجمة البشرية (HTR).

Introduction:

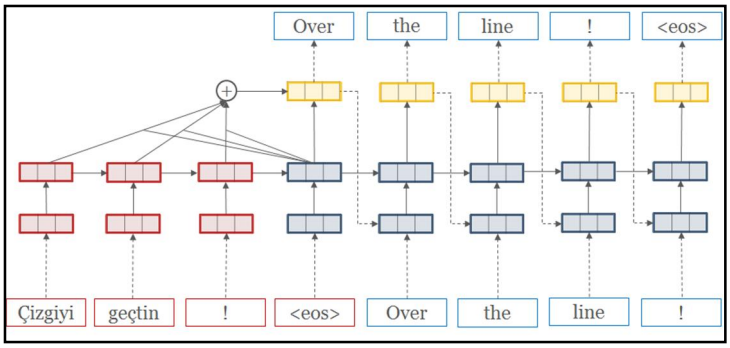
Neural Machine Translation (NMT) has emerged as a successor of statistical MT that has made rapid progress in recent years, and it is paving its way into the translation industry as well: Google Translate (G-NMT) is one of the tools for Interactive Communication between languages in the age of globalization in all its forms and channels *(Sin-wai Chan, 2018)*. Based on the analysis study, the goal of this paper is to evaluate Arabic to French G-NMT output accuracy. To reach this aim, we have selected a short informative news text and its G-NMT Arabic - French output as the material of the study, in which the intended text was analyzed segment by segment and then compared with the Human Translation Reference (HTR) provided by us.

1. Neural Machine Translation (NMT):

Neural Machine Translation (NMT) is a recently proposed method of Machine Translation (MT). It is an end-to-end learning approach for automated translation, with the potential to overcome many of the weaknesses of conventional phrase-based translation systems *(Yonghui Wu et al.,2016, Barrachina et al., 2008; Green et al., 2014, Knowles and Koehn 2016 and Wuebker et al. 2016)*. Unlike traditional Machine Translation (MT), Neural Machine Translation (NMT) aims to build a single neural network (See Figure 1) that can be adjusted jointly to maximize translation performance in a possible short time. Neural Machine Translation (NMT) is an extension of Machine Translation (MT), which works without the translator's intervention, but it is not good enough to produce high-quality translations *(Rebecca Knowles,2019)*, so it is common for the translator to interfere in the translation process to improve the machine's translation output (MT output), through a typical intervention at some stage known as post-editing (PE).

Figure 1

Neural Machine Translation (NMT) architecture



Source: (Image obtained from https://opennmt.net/)

1.2. What about Google Translate?

Google Translate is a free online translation service developed by Google (see Figure: 2), which can translate text, conversations, images, and websites simultaneously, between (103) supported languages in addition to fourteen languages being developed. The service was launched for the first time in April of 2006.

Today, Google Translate is mainly based on Neural Machine Translation (NMT), but without interactivity. Initially, the service started Statistical Machine Translation (SMT), and the research talks today about what is known as the Deep Interactive Neural Translation Prediction (DINTP) that *SYSTRAN* is developing. Which is one of the oldest companies in the field of Machine Translation (MT) in the defense department in the United States, and this company has provided very sophisticated Machine Translation (MT) programs but in specialized fields such as media, defense, trade, and finance.

Figure 2

Arabic–French "Google translate" output

Source: "Google translate" Screenshot. (Taken from https: /translate.google.com/)

Where "Google translate" depends mainly on the algorithm of the translation program, the algorithm learns from the patterns and iterations in which the phrases are translated into other languages on the Internet and from users, as it allows them to evaluate its translation whether it is "correct", "incorrect", or even "wrong", and it also provides several other options when you click on the translated phrases, and it learns from the translation chosen by the users.

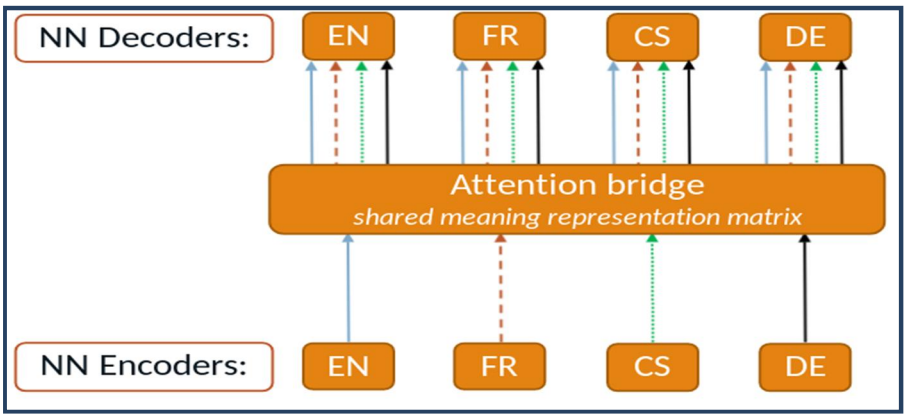
1.2.1. Multilingual G-NMT:

In Google-Neural Machine Translation (G-NMT) multilingual system, the English language has been used as a bridge between any two languages, an operation called "Zero-Shot Translation" or "language-independent attention bridge" (See figure 3).

When you translate a word from Arabic to French for example (as in our case of study), Arabic will be translated first into English, then the translation will be from English to French, and of course, all this process will happen in the least part of the second. This means that when translating between two languages that are not between them English, the Google-Neural Machine Translation (G-NMT) performs two consecutive operations and this will increase the rate of loss in translation, according to *Gina Abou Fadel*, Professor of Languages and Translation, Saint Joseph University, Ecole de Traducteurs et d'Interprètes de Beyrouth*(2005 جينا ابوفاضل سعد،)*.

Figure 3

The G-NMT attention bridge mechanism



Source: Image obtained from https://medium.com/

In addition, there are some languages in which the number of operations exceeds two, for example: If you want to translate a word from the Catalan language to Chinese, "Google Translate" will first translate the Catalan word into a Spanish word, which is the origin of this language in this case. It then translates the Spanish word to English, and then from English to Chinese, which is also done in a split second.

2. Research question:

This research paper aimed to evaluate and compare the accuracy of online G-NMT in translating an Arabic language text taken from *El-Massa* newspaper

(See Figure 4) into French. More precisely, the study aimed to answer the following question:

- How effective is the online G-NMT in translating Arabic into French of a short informative news text?

Figure 4

Informative news text of El-Massa newspaper

تنظيم سلسلة من الورشات لمراجعة منظومة الإعلام

كشف وزير الاتصال، الناطق الرسمي للحكومة، عمار بلحيمر، أمس، عن التحضير لتنظيم سلسلة من الورشات، تهدف إلى مراجعة منظومة الاتصال، بمشاركة الخبراء والأكاديميين ومختلف الفاعلين في القطاع، مشيرا إلى أن أول ورشة ستكون يوم 20 فيفري الجاري حول المواقع الإلكترونية.

وقال الوزير في تصريح للصحافة على هامش جلسة علنية بالمجلس الشعبي الوطني، خصصت لعرض ومناقشة مخطط عمل الحكومة، إن "الورشة الأولى ستحتضنها المدرسة العليا للصحافة يوم 20 فيفري الجاري، بمشاركة الخبراء والأكاديميين والفاعلين في القطاع، لمناقشة مضمون مشروع قانون متعلق بالمواقع الإلكترونية، قبل عرضه على المصادقة من قبل الجهات المختصة".

وأوضح في سياق متصل أنه سيتم "إعادة النظر في عدد من القوانين، على غرار قانون الإشهار"، مشيرا إلى أن "المجلس الوطني للصحافة سيعوض سلطة ضبط الصحافة المكتوبة وسيتولى مهمة اعتماد البطاقة المهنية للصحفي ويراقب عملية توزيع الإشهار ويسهر على احترام أخلاقيات المهنة".

وشدد وزير الاتصال بالمناسبة على "أهمية انتهاج حوار جاد يجمع المهنيين والخبراء والأكاديميين وكذا نقابة الصحفيين وجميع المتدخلين في قطاع الاتصال"، مشيرا إلى أن قطاعه "يتبنى مقاربة جامعة لا تقصي أي طرف وهذا بعيدا عن أي تصفية حسابات".

ق.و

Source: Screenshot obtained from https://www.el-massa.com/dz/news

3. Methods and Materials:

This comparative study aimed to evaluate the quality of G-NMT output by comparing the numbers and percentages of errors occurring in Arabic into French translation output with the human translation (HT) using Google translate service (Figure 2). A descriptive qualitative and quantitative analysis of adequacy and fluency of the G-NMT output was carried out depending on the human translation reference HTR (See figure 5). It is also important to highlight that adequacy and fluency are usually judged on a 1–5-point scale (5 is best) *(Mirjam Sepesy Maučec and Gregor Dona, 2019,1.)*, as given in Table 1.

Table 1

Numeric scale for judging adequacy and fluency

Adequacy		**Fluency**	
5	All meaning	5	Flawless language
4	Most meaning	4	Good language
3	Much meaning	3	Non-native language
2	Little meaning	2	Disfluent language
1	None	1	Incomprehensible

Source: Mirjam Sepesy Maučec and Gregor Donaj, 2019,1.

3.1."Google translate" service :

Google translate is the most common and frequently online NMT used application for a free quick translation. The Algerian users (mainly students) attend to use the "Google Translate" service perhaps because it is an NMT Arabic to French application that is available by default on the Google browser and for free. Since, this application has also several options like "speaker, paraphrase, write, and language checker", and these options could be some of the reasons that motivated Algerian students to use it, the fact that inspired the writer of this article.

3.2. Evaluation Method of G-NMT output:

The study opted to conduct the human evaluation type of the quality of the G-NMT output rather than the automated method Translation Quality Assessment *(House 2014: 21)*. This process required a descriptive analysis of the numbers and means of correct and incorrect scores of the translated segments *(Mohammed Ali, 2020:530)*. This assessment process would be based on comparing the translated segments to the reference (model) counterpart text (HTR) (figure 5).

Figure 5

Human Reference Translation (HRT)

Série d'ateliers consacrée à la réforme du secteur de la communication

Un atelier consacré à la réforme du secteur de la communication se tiendra le 20 février en cours, avec la participation de l'ensemble des professionnels du secteur, a annoncé mardi le ministre de la Communication, Porte-parole du gouvernement, Ammar Belhimer. Dans une déclaration à la presse en marge d'une séance publique à l'Assemblée populaire nationale (APN) consacrée à la présentation du plan d'action du gouvernement, M. Belhimer a précisé que cet atelier, le premier d'une série d'ateliers prévus sur la réforme du secteur de la communication, aura lieu à l'Ecole supérieure de journalisme et "réunira l'ensemble des professionnels du secteur, des académiciens, des opérateurs et des experts pour examiner un avant-projet de loi sur la presse électronique avant son adoption par l'Exécutif". Le porte-parole du gouvernement a annoncé également "la révision de certains textes de loi régissant le secteur de la communication, notamment en matière de publicité ", soulignant que "le Conseil national de la presse remplacera l'Autorité de régulation de la presse écrite qui aura pour missions d'établir la carte professionnelle, contrôler la diffusion par rapport à la publicité et veille au respect de l'éthique de la profession. Ammar Belhimer n'a pas manqué d'insister sur "l'importance d'instaurer un dialogue permanent entre les professionnels du secteur, les experts, les académiciens ainsi que le Syndicat des journalistes et toutes les parties prenantes à l'acte de communication dans une démarche 'inclusive et résiliente"'.

Source: Provided by the writer of this article.

Translation quality for each of the output text would be calculated through the total numbers of adequacy and fluency errors and the percentage of total translation errors related to G-NMT, and this would eventually lead to identifying if the application would perform a higher quality of G-NMT from Arabic to French comparing to HTR.

To carry out the present process of evaluation, it was deemed necessary to divide the Arabic text ST (See figure 4) into "semantic segments" and to judge their translations in terms of adequacy and fluency according to the HRT (Figure 5). In this sequence, the text was divided into (22) semantic segments (As shown in Table 2). Each online translation package could therefore score a maximum of (110) points for adequacy and the same number of points for fluency for each ST produced. To avoid subjective judgments, the French counterpart text of the original ST text (HTR) was used as the reference in the evaluation process which would judge whether each of these segments was conveyed into the TT correctly or incorrectly.

Table 2

Error analysis of Arabic to French G-NMT translation

N	Input sentence	Output G-NMT	A	F
1	تنظيم سلسلة من الورشات لمراجعة منظومة الإعلام	Organisation d'une série d'ateliers pour passer en revue le système médiatique	2	**3**
2	كشف وزير الاتصال، الناطق الرسمي للحكومة، عمار بلحيمر، أمس،	Hier, le ministre de la Communication et porte-parole du gouvernement Ammar Belhimer a révélé	5	**5**
3	عن التحضير لتنظيم سلسلة من الورشات،	les préparatifs en vue de l'organisation d'une série d'ateliers	4	**5**
4	تهدف إلى مراجعة منظومة الاتصال،	visant à revoir le système de communication,	3	**4**
5	بمشاركة الخبراء والأكاديميين ومختلف الفاعلين في القطاع،	avec la participation d'experts, d'universitaires et de divers acteurs du secteur,	4	**3**
6	مشيرا إلى أن أول ورشة ستكون يوم 20 فيفري الجاري	notant que le premier atelier aura lieu le 20 février, ?	4	**5**
7	حول المواقع الإلكترونية.	sur les sites Web.	3	**3**
8	وقال الوزير في تصريح للصحافة على هامش جلسة علنية	a déclaré le ministre. Dans une déclaration à la presse en marge d'une séance publique	5	**2**
9	بالمجلس الشعبي الوطني، خصصت لعرض ومناقشة مخطط عمل الحكومة،	à l'Assemblée populaire nationale, ? à approuver par les autorités compétentes.	2	**2**
10	إن الورشة الأولى ستحتضنها المدرسة العليا للصحافة يوم 20 فيفري الجاري،	«Le premier atelier sera accueilli par l'École supérieure de journalisme le 20 février, ?	4	**4**
11	بمشاركة الخبراء والأكاديميين والفاعلين في القطاع،	avec la participation d'experts, d'universitaires et d'acteurs du secteur,	5	**3**

12	" لمناقشة مضمون مشروع قانون متعلق بالمواقع الإلكترونية، قبل عرضه على المصادقة من قبل الجهات المختصة".	pour discuter du contenu d'un projet de loi lié aux sites Web, avant sa présentation», ?	3	**2**
13	وأوضح في سياق متصل أنه سيتم "	Il a expliqué, dans un contexte connexe,	2	**2**
14	إعادة النظر في عدد من القوانين، على غرار قانون الإشهار"،	qu'un certain nombre de lois seront révisées, similaires à la loi sur la publicité,	4	**4**
15	مشيرا إلى أن "المجلس الوطني للصحافة سيعوض سلطة ضبط الصحافة المكتوبة	indiquant que le Conseil national de la presse remplacera l'autorité de contrôle de la presse écrite	4	**4**
16	وسيتولى مهمة اعتماد البطاقة المهنية للصحفي	et prendra en charge la tâche d'adoption de la carte professionnelle du journaliste,	4	**4**
17	ويراقب عملية توزيع الإشهار ويسهر على احترام أخلاقيات المهنة".	surveille la diffusion de la publicité et veille au respect de l'éthique de la profession.	5	**5**
18	وشدد وزير الاتصال بالمناسبة على	A l'occasion, le ministre de la Communication a souligné	3	**4**
19	"أهمية انتهاج حوار جاد يجمع المهنيين والخبراء والأكاديميين	«l'importance de poursuivre un dialogue sérieux qui rassemble des professionnels, des experts et des universitaires,	3	**4**
20	وكذا نقابة الصحفيين وجميع المتدخلين في قطاع الاتصال"،	ainsi que le Syndicat des journalistes et tous les acteurs du secteur de la communication»,	5	**5**
21	مشيرا إلى أن قطاعه "يتبنى مقاربة جامعة لا تقصي أي طرف	indiquant que son secteur «adopte un approche inclusive qui n'exclut aucune partie	4	**3**
22	وهذا بعيدا عن أي تصفية حسابات".	et qui est loin de tout règlement de compte. »	5	**4**

Source: From our case study analysis.

Table 3

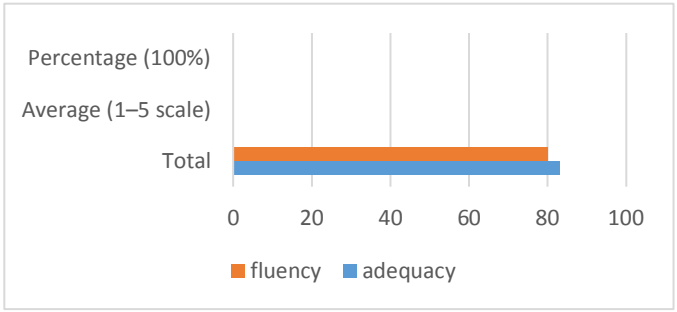
Adequacy and Fluency total percentage

QA	adequacy	fluency
Total	83	80
Average (1–5 scale)	0.83	0.80
Percentage (100%)	0.17	0.16

Source: From our case study analysis.

Graphic 1

Adequacy & Fluency Total percentage



Source: From our case study analysis.

Table 4

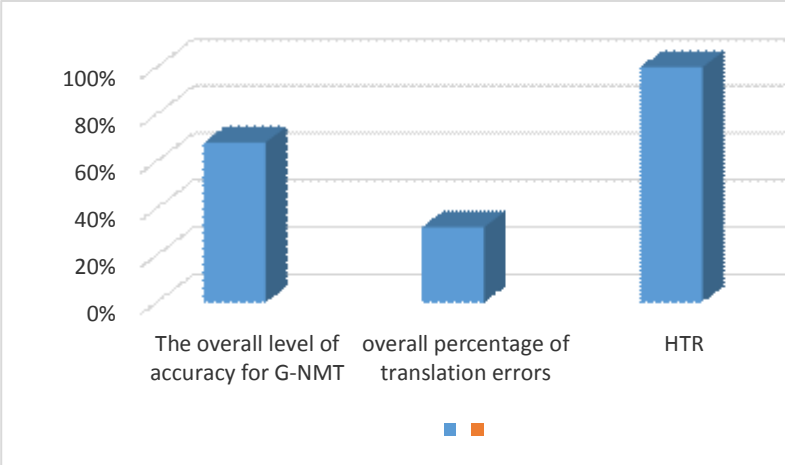
G-NMT accuracy and overall percentage of translation errors

	adequacy errors	fluency errors	The overall percentage of translation errors
Final score	**13.63%**	**18.18 %**	**31.81%**
The overall level of accuracy for G-NMT			**68.18%**

Source: From our case study analysis.

Graphic 2

G-NMT overall level accuracy compared to HTR



Source: From our case study analysis.

4. Analysis and Discussion:

In the attempt to evaluate the performance of the free online G-NMT tool (Google Translator) in translating Arabic into French informative news text taken from *El-Massa* newspaper (As shown in Figure 4), the present study quantitatively analyzed the total number and the percentage of total translation errors in the target text (TT), after the qualitative semantic and syntactic study of the source and the target text compared to Human Translation Reference (HTR) (Figure 5).

The findings showed that TT was having an acceptable adequacy and fluency score which means a sufficient accuracy for reading comprehension of TT, in the percentages of errors, were Google's translation (31.81% percentage of errors) (Table 4). This percentage of errors for the TT as translated via Google Translate seemed to be an accurate translation. While the translation output displays (Table 3) some serious lexical, syntactical, and grammatical errors which lead to a loss of the message presented in the ST.

Google Translate gave a good overall performance in the translation of the (22) statements into French in terms of semantic adequacy, but not in terms of fluency (As shown in both table 3 and Graphic 1) maybe because each one of the two languages targeted belongs to different language families that have diverse linguistic systems and cultures. While French belongs to the Romance family of languages, Arabic belongs to the Semitic family *(Britannica/French-language)*. This makes the translation process a bit complicated and sometimes results in numerous translation errors that distort the concept to be conveyed. Another reason may be taken into account that Google-Neural Machine Translation (G-NMT) performs two consecutive operations and this will increase the rate of loss in translation, as explained above (Multilingual G-NMT mechanism) a case that contributed to the percentage of total translation errors that reached)31.81% in Google's translation (Table 4). As summarized in (Table 4), the overall percentage of translation errors is (31.81%) percentage of the (03) adequacy errors out of the 22 segments are (13.63%), and the (04) fluency errors out of the (22) segments is (18.18 %). That means that the overall level of accuracy for Google translation is (68.18%) a sufficient accuracy for comprehension reading of TT (Graphic 2).

Table (4), also reveals that adequacy and fluency problems are caused by different types of errors, among these problems are:

- **Example of a mistranslation error:**

(E.g., segment1),

Arabic input: تنظيم سلسلة من الورشات لمراجعة منظومة الإعلام

French G-NMT output : Organisation d'une série d'ateliers pour passer en revue le système médiatique

French HTR : Série d'ateliers consacrée à la réforme du secteur de la communication

The expression "لمراجعة منظومة الإعلام" has been mistranslated by G-NMT. It could not differentiate between the expressions "منظومة الإعلام" and " Secteur de la communication," as they have been translated identically. However, there is a difference between the phrases "le système médiatique" and "secteur de la communication." The HTR maintains this difference taking into consideration the context.

- **Example of an omission error:**

(E.g., segment 6),

Arabic input : فيفري الجاري20مشيرا إلى أن أول ورشة ستكون يوم ....

French G-NMT output : Notant que le premier atelier aura lieu le 20 février, **?**

French HTR : Se tiendra le 20 février en cours,

In this example, the word "الجاري" has been omitted from the TT. However, this omission doesn't entail mistranslation.

- **Example of a lexical error :**

(E.g., segment 6),

Arabic input: وأوضح في سياق متصل أنه سيتم....

French G-NMT output : Il a expliqué, dans un contexte connexe,

French HTR : Le porte-parole du gouvernement a annoncé également "

In the above example, G-NMT has translated the word "متصل" as "connexe ." However, the TT word is used inappropriately in this context, as the word connexe "refers to "analog" in a Connected component of a graph. Such inappropriate usages of words are identified as errors in the G-NMT output.

- **Misuse of feminine and masculine pronouns:**

(E.g., segment 21),

Arabic input: مشيرا إلى أن قطاعه يتبنى مقاربة جامعة لا تقصي أي طرف

French G-NMT output : Indiquant que son secteur « adopte un approche inclusive qui n'exclut aucune partie.

French HTR : Indiquant que son secteur « adopte une approche inclusive qui n'exclut aucune partie.

In this example, the gender of the equivalent of the word"مقاربة" in french is feminine "Une approche "However in G-NMT output is masculine "un approche". This translation corrupts the structure of the French translation.

- **Lack of fluency :**

(E.g., segment 8),

Arabic input: وقال الوزير في تصريح للصحافة على هامش جلسة علنية

French G-NMT output : a déclaré le ministre. Dans une déclaration à la presse en marge d'une séance publique

French HTR : Dans une déclaration à la presse en marge d'une séance publique à l'Assemblée populaire nationale (APN) consacrée à la présentation du plan d'action du gouvernement, M. Belhimer a précisé.

In this example, G-NMT has translated the verb "قال" as " a déclaré ." However, the TT verb is used inappropriately in this context, as the verb " a déclaré "refers to the word "déclaration" used in the same segment such inappropriate usages of words are identified as errors in the G-NMT output.

- **Lack of adequacy and fluency at the same time:**

(E.g., segments 21),

Arabic input:.بالمجلس الشعبي الوطني، خصصت لعرض ومناقشة مخطط عمل الحكومة

French G-NMT output : À l'Assemblée populaire nationale, ? à approuver par les autorités compétentes.

French HTR : Pour examiner un avant-projet de loi sur la presse électronique avant son adoption par l'Exécutif".

In the above example, we see another remarkable source of errors related to accuracy is the inconsistent and inaccurate use of the phrase (خصصت لعرض ومناقشة مخطط عمل الحكومة) by "Les autorités compétentes" in the TT, on the other hand, missing words in G-NMT output has also led to adequacy and fluency errors at the same time.

These numerous errors resulted in an inaccurate conveyance of the message from the ST into the TT; nevertheless, the TT continues to maintain a level of adequacy and fluency. On the whole, the overall percentage of accuracy for G-NMT is 68.18%, which is acceptable compared to reference human translation (HTR). Yet, readers' understanding of the translated text continues to face some hindrances due to the (31.82%) percentage of adequacy and fluency errors. This result, therefore, proves that the translation of the G-NMT application scored a higher quality (73.81% of its translation is correct) of translation in terms of adequacy and fluency. The findings of the present study output may be used as a classroom strategy to help foreign language students enhance their language and translation abilities. This study clearly showed that G-NMT raw output has different linguistic errors, and these could be used for language learning and translation training purposes. The importance of human intervention to improve G-NMT output has also been confirmed.

Conclusion:

This research paper attempts to evaluate and compare the Arabic into French translation output of Google Translate by HRT based on a descriptive qualitative and quantitative analysis of adequacy and fluency of the G-NMT output. For this purpose, a short informative news text was chosen from *El-Massa* Newspaper (See figure 5), and segmented into 22 semantic segments (As shown in Table 2); and the assessment of each semantic segment had two levels: correct or incorrect accuracy of the translation, and correct or incorrect fluency of the translation judged on a 5-point scale (as shown table 1).

The descriptive quantitative analysis of the G-NMT output revealed that little accuracy and fluency errors were met in the TT. Those errors were of different linguist types at the level of word choice and use, and use of prepositions, word order in the segment, use of nouns/pronouns, and the use of feminine or masculine. Surprisingly, the mean percentage of errors in Google's translation was a slight minor error (31.82%). In other words, these results

indicated that the translation of the G-NMT system scored relatively an acceptable quality.

As a result of this description of the errors and their types, this study recommends that language and translation instructors may use similar French translated output and their Arabic origin in classroom activities to help students improve their language and translation skills. It is also important to keep in mind that through the continuous development in the field of artificial intelligence (AI), G-NMT is always witnessing improvements in its applications, so further researches are recommended to evaluate more G-NMT output as well as in different types of texts and languages pair. Finally, despite the disadvantages of Neural Machine Translation (NMT) as provided by the "Google translate" (31.82%) in the case of this study, this system can overcome the obstacles that were facing human communication in the short possible time and for free, but it is still far from the productivity achieved by Hunan Translator (HT).

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