

## Thai Poetry in Machine Translation: An Analysis of Poetry Translation using Statistical Machine Translation

**Waijanya S.**

Faculty of Information Technology, King Mongkut's University of Technology North Bangkok, Bangkok 10800, Thailand

Email address: Sajjaporn.w@gmail.com

**Mingkhwan A.**

Faculty of Industrial and Technology Management, King Mongkut's University of Technology North Bangkok, Prachinburi, Thailand

Email address: anirach@ieee.org

### Abstract

The poetry translation from original language to another is very different from general machine translator because the poem is written with prosody. Thai Poetry is composed with sets of syllables. Those rhymes, existing from stanzas, lines and the text in paragraph of the poetry, may not represent the complete syntax. This research is focus on Google and Bing machine translators and the tuning the prosody on syllable and rhyme. We have compared the errors (in percent), between the standard translators to those translators with tuning. The error rate of both translators before tune them, was at 97 % per rhyme. After tuning them, the percentage of errors decreased down to 60% per rhyme. To evaluate the meaning, concerning the gained results of both kinds of translators, we use BLEU (Bilingual Evaluation Understudy) metric to compare between reference and candidate. BLEU score of Google is 0.287 and Bing is 0.215. We can conclude that machine translators cannot provide good result for translate Thai poetry. This research should be the initial point for a new kind of innovative machine translators to Thai poetry. Furthermore, it is a way to encourage Thai art created language to the global public as well.

**Keywords:** Thai poetry translation; translation evaluation; Poem machine translator

### 1 Introduction

Poetry is one of the fine arts in each country. The French poet Paul Valéry defined poetry as "a language within a language." [1]. Poetry can tell a story, communicate by sound and sight and can simply express feelings. Poetry translation from original language to other languages is the way to propagate the own culture to other countries in the world.

Machine translation of poetry is the challenge for researchers and developers [2]. According to Robert Frost's definition, "Poetry is what gets lost in translation". This statement could be considered, it's very difficult to translate poetry from original language to other languages with original prosody. This is because poetry has specific syntax (prosody) in the different poetry type. They different in

line-length (number of syllable), rhyme, meter and pattern. Many researches try to develop poetry machine translator to translate Chinese poetry, Italian poetry, Japanese (Hiku) poetry, Spanish poetry to English and translate back from English to original language such as Poetry of William Shakespeare. They were developing poetry machine translation based on a statistical machine translation technique.

For Thai Poetry and Thai Poet, Phra Sunthorn Vohara, known as Sunthorn Phu, (26 June 1786–1855) is Thailand's best-known [3] royal poet. In 1986, the 200th anniversary of his birth, Sunthorn Phu was honored by UNESCO as a great world poet. His Phra Aphai Mani poems describe a fantastical world, where people of all races and religions live and interact together in harmony. But In

Machine translation area, we never found the research about Thai poetry machine translation. Thai poetry has five major types are Klong, Chann, Khapp, Klonn and Raai.

In this paper we use the Thai prosody "Klon-Pad (Klon Suphap)" in order to translate to English. Klon-Pad has the rules of syllable, Line (Wak), Baat, Bot and relational rule of syllable in each Wak [4]. There are relations to beauty in content of creative writing and different for the prosody. Thai poetry has complexity of rhyme and syllable. Each line (Wak) of Thai poetry is not a complete sentence (SOV-Subject Object Verb). Furthermore, some Thai words can have several meanings while translated to English. These are the reasons why it is difficult to develop Thai poetry machine translator. Our studies are about two Bot of Klon8 Thai Poetry translate by two statistically machine translator which are Google Translator [5] and Bing Translator [6]. Then we tune the prosody using a dictionary and compare result of English poetry with Thai prosody in section 3. We use a case study from "Sakura, TaJ Mahal" [7] by Professor Srisurang Poolthupya to have a reference in evaluation by BLEU (Bilingual Evaluation Understudy) metric in section 4. Section 5 concludes this paper and points out the possible further works in this direction.

## 2 Related Works

Although we cannot find any research related to machine translator of Thai poetry to English, there are several research papers related to machine translation poetry from Chinese to English, Italian to English and French to English.

### A. *A Study of Computer Aided Poem Translation Appreciation* [8]

This paper collecting three English versions of "Yellow Crane Tower" a poem of the Tang dynasty, applies the computational linguistic techniques available for a quantitative analysis, and use BLEU metrics for automatic machine translation evaluation. The conclusion of the currently available, computational linguistic technology is not capable of analyzing semantic calculation, which is, without a doubt, a severe drawback for poetry translation evaluation.

### B. *"Poetic" Statistical Machine Translation: Rhyme and Meter*[9]

This is a paper of Google MT (Machine Translator) Lab. They use Google translator. Therefore they implement the ability to produce translations with meter and rhyme for phrase-based MT. They train a baseline phrase-based French-English system using WMT-09 corpora for training and evaluation, and use a proprietary pronunciation module to provide phonetic representation of English words. The evaluation use BLEU score.

The result of this research has the baseline BLEU score of 10.27. This baseline score is quite low and also has problem of system performance, it is still slow.

### C. *Automatic Analysis of Rhythmic Poetry with Applications to Generation and Translation*[10]

This paper applies unsupervised learning to reveal word-stress patterns in a corpus of raw poetry and use these word-stress patterns, in addition to rhyme and discourse models, to generate English love poetry. Finally, they translate Italian poetry into English, choosing target realizations that conform to desired rhythmic patterns. In the section of poetry generation, FST (Finite State Transition) is used. However, this technology is having various problems, if the results have to be evaluated by humans. In part of poetry transition they use PBTM (Phrase base transition with meter). The advantage of poetry translation over generation is that the source text provides a coherent sequence of propositions and images, allowing the machine to focus on "how to say" instead of "what to say."

## 3 Our Proposed Approach

### A. *Methodology*

#### 1) *Machine Translations*

MT (Machine translation) is sub-field of computational linguistics that investigates the use of software to translate text or speech from one natural language to another. MT has two major types. These are rule-base machine translation and Statistical Machine Translation Technology.

- a) *Rule-based machine translation*: Relies on countless built-in linguistic rules and millions of bilingual dictionaries for each language pair. The rule-based machine translation includes transfer-based machine translation, interlingual machine translation and dictionary-based machine translation paradigms. A typical English sentence consists of two major parts: noun phrase (NP) and verb phrase (VP).
- b) *Statistical machine translation*: based on bilingual text corpora. The statistical approach contrasts of the rule-base approaches to machine translation as well as with example-based machine translation.

Both translators from Google and Bing use statistical machine translators. Moreover our team is using an API for Google and Bing translators to translate Thai poetry.

2) *English Syllables Rule and Phonetics.*

Syllables are very important in prosody of Thai Poetry. Each Wak has a rule for number of syllables. Relation between Wak and Bot has to check the sound of the syllable. Every syllable consists of a nucleus and an optional coda. It is the part of the syllable used in poetic rhyme, and the part that is lengthened or stressed when a person elongates or stresses a word in speech.

The simplest model of syllable structure [11] divides each syllable into an optional onset, an obligatory nucleus, and an optional coda. Figure 1 is showing the structure of syllable.

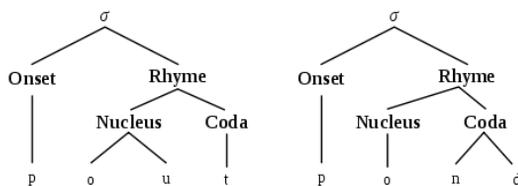


Figure 1: Structure of syllable

Normally we can check the relation of rhymes, by checking them relation of the sound in the syllable. This is called Phonetics. It can help us, to get to know how to pronounce the word.

B. *An Algorithm and Case Study*

1) *System Flowchart*

To study Thai Poetry in Machine Translation, we use Thai poetry Klon-Pad 2 Bot (8 lines) as input to this process. Figure 2 is showing a system flowchart of this process.

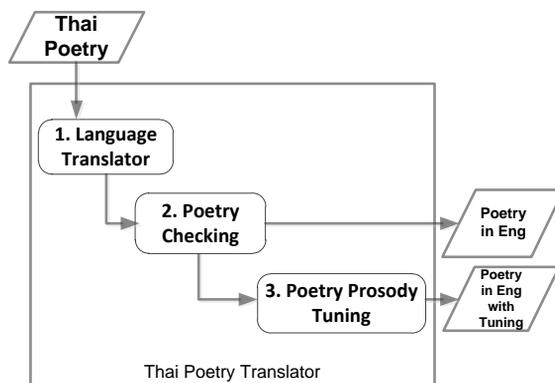


Figure 2: System flowchart of Thai poetry in Machine Translation

In Figure 2, we design three modules to translate Thai poetry to English.

- a) *Language Translator*: we use Google and Bing API Machine Translator to process Thai Poetry translates to English.
- b) *Poetry Checking*: used to check prosody of poetry after translate to English. The result of this module is Thai poetry in English and error point of the poetry itself.
- c) *Poetry Prosody Tuning*: after process module2 (Poetry Checking) we collect error points and tuning the poetry by using a dictionary and a thesaurus. An expected result of this module is the percentage of error will decrease.

*Case Study*: we process twenty Klon-Pad Thai poetry via three modules without reference in term of English translation by professional, and we process one of Thai poetry from “Sakura, TaJ Mahal” by Professor Srisurang Poolthupya as reference and use result from Google and Bing API as reference to calculate BLEU score.

We describe three modules in sub-section 2), 3) and 4) and in Figure 3 and Figure 4.

2) *Language Translator Module*

This module process input Thai poetry (Klon-Pad) in term of Thai language to translate to English by Google and Bing API Machine Translator. Figure 3 is showing a process of this module.

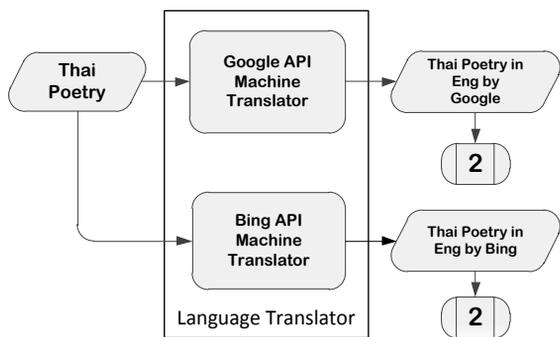


Figure 3: Language Translator Module

a) Case Study1, Original Thai Poetry: Thai Poetry “Deuan-chaai” from book “Oh jão dòk máai oie”.

เป็นพันธุ์ไม้ล้มลุกปลูกแสนง่าย  
 ชื่องามเด่น“เดือนฉาย”ใจถวิล  
 สีเหลืองบ้างแดงบ้างช่วง โศกทิน  
 ดอกเจิดจรัสสร้างบานทั้งวัน  
 “เดือนฉาย”ใช้จะแข่งแสงเดือนส่อง  
 เพียงชื่อพ้องเพราะพริ้งสมจริงนั้น  
 ยิ่งได้งใส่ปุ๋ยเดือนฉายยิ่งพรายพรณ  
 เกินจะสรรเสกพรำคำยอชื่นขอ

b) Case Study1, Translate by Google API:

A herbaceous plant species growing easy.  
 A good performance ‘in film’ I Tawil.  
 Some red, some yellow Ospin technician.  
 Eaidain flowers and clean the whole day.  
 ‘Month Movie’ I will be racing in the light shines.  
 Just to name a synonym is real nice there.  
 The fertilizer plant in projecting the profile.  
 Keeps up the quality scale flattery.

c) Case Study1, Translate by Bing API:

As the cultivation of plant species is very easy.  
 Strong desire to make beautiful films a month name.  
 Yellow and red are really sophin?  
 Flores choetchin prominent pane all day.  
 Last month, the race featured a Moonlight illuminates.  
 Only the name Allied euphonic to life there.  
 Even more sparkling variety fertilizer month projection  
 We are too badly, the excessive praise.

### 3) Poetry Checking Module

This module processes Thai poetry in English term from Google and Bing API. We analyses syntax and collected error points for prosody of Klon-Pad Thai poetry in twenty poetries. Figure 4 is showing a process of the Poetry Checking Module.

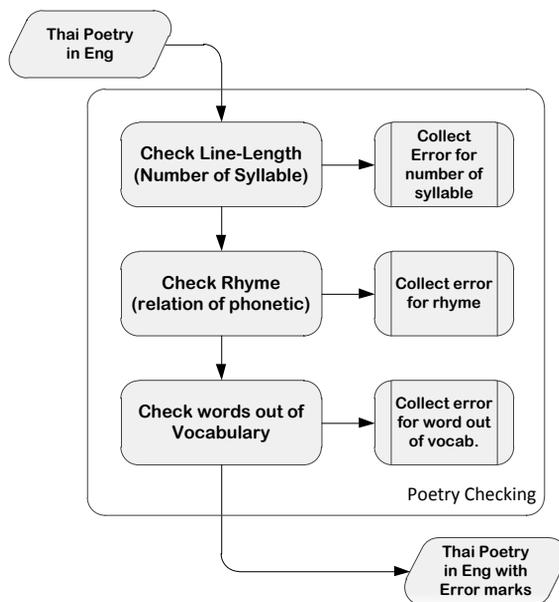


Figure 4: Poetry Checking Module

a) Check Line Length (Number of Syllable): Thai poetry has prosody for number of syllable in line. In each line are 7 to 9 syllables allowed. If one line is having more than 9 or less than 7 syllables, an error is implicated in the length of the line.

From Case Study, Translate by Google API: we found 7 error lines as Table 1 below is showing.

Table 1: An example: Thai poerty “Deuan-chaai” translate by Google API.

Google Version	Syllable Count
A herbaceous plant species growing easy	11
A good performance ‘in film’ I Tawil.	10
Some red, some yellow Ospin technician.	10
Eaidain flowers and clean the whole day.	9 <sup>a</sup>
‘Month Movie’ I will be racing in the light shines.	12
Just to name a synonym is real nice there.	11
The fertilizer plant in projecting the profile.	13
Keeps up the quality scale flattery.	10

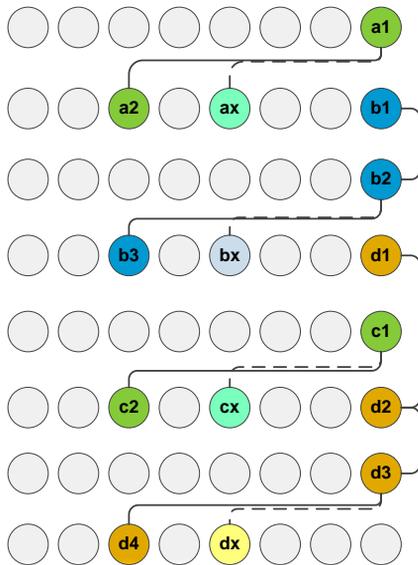
a. 9 syllables is not error in prosody for number of syllable in line

**Table 2:** An example: Thai poetry “Deuan-chaai” translate by Bing API.

Bing Version	Syllable Count
As the cultivation of plant species is very easy.	15
Strong desire to make beautiful films a month name.	12
Yellow and red are really sophin?	10
Flores choetchin prominent pane all day.	10
Last month, the race featured a Moonlight illuminates	13
Only the name Allied euphonic to life there.	13
Even more sparkling variety fertilizer month projection	17
We are too badly, the excessive praise.	10

Table 1 and 2 represents the numbers of syllables in each wak. While using Google API, this poem has only one wak, in which this number of syllables is correctly translated. When Bing API was used, not a single wak had the correct number of syllables, they are all error tagged.

b) *Check Rhyme (Relation of Phonetic):* Thai poetry has a rule for them Rhyme. For Klon-Pad we present the rule of Rhyme in figure 5.



**Figure 5:** Rhyme Prosody for Thai Poetry Klon-Pad (2 Bot)

Figure 5 show Thai poetry Klon-Pad Two Bot with 14 rules of Rhyme as flowing

- R1 relation of a1 and a2 or a1 and ax
- R2 relation of b1 and b2
- R3 relation of b1 and b3 or b1 and bx
- R4 relation of b2 and b3 or b2 and bx
- R5 relation of b1, b2 and b3 or b1, b2 and bx
- R6 relation of c1 and c2 or c1 and cx
- R7 relation of d1 and d2
- R8 relation of d1 and d3
- R9 relation of d1 and d4 or d1 and dx
- R10 relation of d2 and d3
- R11 relation of d2 and d4 or d2 and dx
- R12 relation of d2, d3 and d4 or d2, d3 and dx
- R13 relation of d3 and d4 or d3 and dx
- R14 relation of d1, d2, d3 and d4 or d1, d2, d3 and dx

In this process, we check the relation of the syllables referred to the rule. A relation in Thai poetry means similar of pronunciations but it does not duplicate.

- *Example 1:* “today” relate with “may”, this is correct by rules of Rhyme.
- *Example 2:* “today” relate with “Monday”, this is error (duplicate) by rules of Rhyme.
- *Example 3:* “today” relate with “tonight”, this is error (not relate) by rules of Rhyme
- *Case Study1, Translate by Google API:* We found number of **error 13** rule and correct in rule R3.
- *Case Study1, Translate by Bing API:* We found number of **error 12** rule and correct in rule R1 and R3.

c) *Check Words out of Vocabulary:* We used a dictionary and thesaurus to check the meaning of these words. We found out that MT tried to translate those words by write them in term of phoneme. Actually those words might have a meaning in Thai language, but it is to complex to translate them from Thai to English in only one step. Many words should first be translated from Thai to Thai, before they can be sent to MT. Those words, MT was not able to translate, we will furthermore call in this paper: “Words out of Vocabulary”. Moreover, these words get error tagged.

- *Case Study1, Translate by Google API:* We found **3 words out of vocabulary**. There are *Tawil*, *Ospin* and *Evidwin*. *Tawil* means 'to miss someone' or 'to think of someone'. *Ospin* means 'beautiful' and *Evidwin* means 'beautiful'.
- *Case Study1, Translate by Bing API:* We found **2 words out of vocabulary**. There are *sophin* and *choetchin*. *Sophin* means 'beautiful' and *choetchin* means 'beautiful'.

#### 4) Poetry Prosody Tuning.

To study about basic tuning for Poetry translated by MT. Therefore we use twenty poetries in MT to test to approach. Our basic approaches are:-

- Word out of vocabulary:* translate Thai to Thai before translate by MT.
- Number of Syllable Error:* the majority of the occurred errors, are having more syllables as they are allowed to have. Then we used a dictionary and thesaurus to reduce the length of the sentences by the help of shorter words. Afterwards an omission of the articles like "a", "and" as well as "the" was an additional possibility to decrease the length.
- Rhyme Error:* we tune this error by the use of a dictionary and thesaurus to change words in Rhyme position.

### C. Measurement Design

In this paper we separate two majors kind of measurement.

#### 1) Error percentage

We process twenty Thai poetry by calculates them prosody error percentage as shown in the equation below.

$$Es = \frac{Ps}{Ts} \% \quad (1)$$

Equation (1): *Es* means syllable error percentage of Bot, *Ps* means number of syllable error and *Ts* means total of Wak (8 Waks) in Bot.

We calculate error percent of rhyme by equation (2) flowing.

$$Er = \frac{Pr}{Tr} \% \quad (2)$$

Equation (2): *Er* means Rhyme error percentage of Bot, *Pr* means number of rhyme error and *Tr* means total Rhyme (14 rhyme position) in Bot.

We calculate the error percentage related to the wrong used words by the help of a vocabulary. See the following equation (3)

$$Ew = \frac{Pw}{Tw} \% \quad (3)$$

Equation (3): *EW* describes the percentage of vocabulary errors per Bot. In this context *PW* is the number of wrong words and *TW* the total number of words per Bot. Maximal 72 words could be possible.

Finally we calculate the average percentage of each error type for all twenty poetries. On this way we can create a summary to evaluate the results.

#### 2) BLEU Score

BLEU (Bilingual Evaluation Understudy) [12] is an algorithm for evaluating the quality of text which has been machine-translated from one natural language to another. Quality is considered to be the correspondence between a machine's output and that of a human. BLEU uses a modified form of precision to compare a candidate translation against multiple reference translations. The metric modifies simple precision since machine translation systems have been known to generate more words than appear in a reference text. Equation of BLUE is showed in equation 4.

$$BLEU = BP \bullet \exp\left(\sum_{n=1}^N w_n \log p_n\right) \quad (4)$$

When  $P_n$ : Modified n-gram precision, Geometric mean of  $p_1, p_2, \dots, p_n$ .

*BP*: Brevity penalty ( $c$ =length of MT hypothesis (candidate),  $r$ =length of reference)

$$BP = \begin{cases} 1 & \text{if } c > r \\ e^{(1-r/c)} & \text{if } c \leq r \end{cases} \quad (5)$$

In our baseline, we use  $N = 4$  and uniform weights  $w_n = 1/N$

## 4 Experiment Results

In our experiments we translated twenty poetries by two machines translations which are Google API and Bing API. Both of MT is Statistical Machine Translation. In case study2 we use poetry from "Sakura, TaJ Mahal" by Professor Srisurang Poolthupya as reference and translate Thai poetry from this book by Google and Bing as candidates. This case study we evaluate by BLEU score. Finally,

we summary the results as shown in the following part.

A. Result of Thai poetry in Google and Bing Translator.

In Table 3, we show the percentage of errors from three error types before tuning those result. Most of these errors are mistakes of rhyme because MT is not able to understand poetry of rhyme and meter. In the column of “Tuning” the percentage of errors after tuning is shown in three parts.

**Table 3:** Percent of Line-length error, Rhyme error and Words out of vocabulary before tuning and after tuning

Items	Translator			
	Google	Google with Tuning	Bing	Bing with Tuning
Total line	160			
Line-length (Number of syllable Error)	50	28	87	33
Percent of syllable Error	31%	18%	54%	21%
Total Rhyme	280			
Rhyme Error	271	158	272	147
Percent of Rhyme Error	97%	56%	97%	62%
Total words	1440			
Word Out of vocabulary	50	15	87	22
Percent of Word Out of vocabulary	2%	1%	3%	2%

B. Case Study2: poetry from “Sakura, TaJ Mahal” and BLEU Evaluation.: The original poetry in Thai and English show in table 4.

**Table 4:** Thai Poetry from book “Sakura, TaJ Mahal”

Original Thai Poetry	Reference: Translate by owner of poetry
ขอน้อมเศศกราบครุกลอนสุนทรภู่	Sunthon Phu, the great Thai poet,
ไปตราับรู้ศิษย์นี้ขอนบไหว	I pay my respect to you, my guru.
ท่านโปรดช่วยอำนวยความสะดวก	May you grant me the flow of rhyme,
อังกฤษของไทยของให้คล้องต้องกระบวน	Both in Thai and in English,
สื่อความหมายหลายหลากไม่ยากเย็น	That I may express my thoughts,
ตรงประเด็นเปรียบเทียบได้ครบถ้วน	In a fluent and precise way,
จับใจผู้วิจารณ์อ่านทั้งหมด	Pleasing the audience and critics,
ช่วยชี้ชวนให้ผ่อนคลายสบายใจ	Inspiring peace and well-being

We use the original English Poetry as reference to compare them to both translators from Google and Bing. The calculated BLEU score is shown in Table 5.

**Table 5:** BLEU Score of candidate from Google and Bing translator

Poetry	BLEU
Google	
I bow my head respectfully <i>Soonthornphu</i> teachers.	0.840
Please get to know us, this makes me <i>respect</i> .	0.905
Please help with any poem.	0.000
<i>Thai English</i> proficiently to process	0.549
Various meanings can be very difficult.	0.000
Relevant comparative information.	0.000
Reading comprehension and critical mass.	0.000
The prospectus provides a relaxed feel.	0.000
<b>Average of BLEU Score</b>	<b>0.287</b>
Bing	
We also ketrapp <i>the</i> teacher verse harmonious Mussel	0.840
Please recognize this request for a given by the audience.	0.000
What a blessing <i>you</i> , help facilitate poem	0.309
Fluent <i>in English, Thai</i> , tongkrabuan	0.574
Describe the various not complicated	0.000
Completely irrelevant comparisons.	0.000
Catching someone reviews read all	0.000
To help you relax, prospectus	0.000
<b>Average of BLEU Score</b>	<b>0.215</b>

5 Conclusion and Future Work

The generated results show that these Machine Translators have many problems by translating Poetry. MT translates poetry without prosody. It is not able to understand Poetry pattern, difficult original words and sentences itself. The reason for that is the operating principle of MT itself. They use Phrase based methods while translating from the original to another language. But Thai Poetry can be written in incomplete sentences. Moreover, Thai words especially words in poetry are very complex. Some words should be translated from Thai to Thai before they can be sending to MT. The reason why poets use more difficult words is a matter of them felling, the beauty of these words and also the beauty of the poetry itself.

The result in this paper is show percent of error too high when we use only of MT to translate poetry especially Rhyme Error. Incidentally, it is possible to decrease the error rate down to 60% when tuning the results of MT. Moreover, the occurred errors of a

backward translation from Thai to Thai could be decreased down between 1% and 2%, if the used words have been out of vocabulary.

The results of BLEU score. In this paper we use only 1 reference for evaluation. In case of BLEU, if we have many references, it is better than only a single reference. However it is very difficult to find reliable references for such an evaluation, except such verified English translations from the owner of the original Thai poetry itself.

This paper is the first research dealing about Machine Translation from Thai poetry to English. In the future, hopefully we are able to establish rules and poetry pattern to use those in combination with MT to translate Thai poetry to English with prosody keeping. The prosody and meaning of poetry are very important when translate to other languages because it can present arts and culture of that country.

#### Acknowledgments

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