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Steps to Emotion Corpus Creation in Thai: An Exploration of Thai Emotion Wordlists, Depression Corpus and Facial Expression in Speech Situation

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Abstract. In this paper, we proposed a two-phase project on emotion corpus creation based on multi-knowledge of cognitive semantics, discourse analysis, paralinguistics, and computer science. Data were gathered from Thai lexicon of five main Thai dictionaries and thesaurus, in addition to written and spoken texts of people with depression in Thai and facial expression with speech situation. We found that semantic primes and features of each emotion were needed to serve as a guideline of emotion categorization in Thai context. We introduced the step-by-step methods of the first phase to create Thai emotion corpus entailing both verbal and nonverbal corpora. The way to classify emotion corpus by focusing on the specific text of depression as well as to find the guidelines of labelling facial expression in the situation of specific emotions was explored. Lastly, the step of creating emotion corpus in the second phase was introduced with some suggestions and discussion.

Keywords. emotion classification, emotion corpus, facial expression, corpus creation

1. Introduction

We live in a world of emotions; our lives, whether we like it or not, are governed by emotions. Denzin [1] points out that emotion is a lived, believed-in, situated, temporally embodied experience that radiates through a person's stream of consciousness and transforms the reality of a world that is being constituted by the emotional experience [1, p.66]. Emotion words have been a focus of research interest in many fields of study, including psychology, literary study, linguistics and natural language processing. Previous studies about emotion conducted by Thai researchers have focused generally on the basic sentiment analysis as polarized system of positive, neutral, negative preferences, or cognitive linguistics, i.e., conceptual metaphor of emotions. Among other studies, research of Angkapanichkit, Rojanahastin and Intasian [2] indicated that, given the significance of language and emotion in people with depression narratives, emotion

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corpus should be established in the Thai language that will lead to the development of tools and techniques for emotion detection in Thai communication. As more demand is in evidence for natural language processing (NLP) to develop Artificial Intelligence (AI) in Thailand, it becomes increasingly necessary to study the ways in which corpus could be created. However, currently neither Thai emotion database, nor research exists to create Thai emotion corpus with clear criteria or guidelines to categorize emotion in terms of basic emotions, not sentiment in Thai. To fill this gap, we propose our research project on creation of Thai emotion corpus both verbal and nonverbal corpora.

Our project entitled 'Thai Emotion Corpus Creation' is a sub-research project of **AI Ready City Networking in Research University Network - RUN**, funded by Thammasat University Research under the TSRI (Contract No. TUFF19/2564). The project is an on-going process to explore Thai Emotion Dataset. This project brings together expertise in cognitive semantics, discourse analysis and multimodal Thai linguistics as well as Data Science and Computational Linguistics to investigate emotion language—both verbal and nonverbal, and to produce a dataset to put alongside the emotion corpus creation in Thai language databases. In this paper, we present the first phase of the study to introduce step-by-step verbal and nonverbal emotion corpus creation in the Thai language.

This paper is organized as follows. In Section 2 we showed some studies related to development and analysis of Thai corpus and emotion. In section 3, we demonstrated steps and methods of emotion corpus creation. Finally, in section 4, we proposed some suggestions for additional work of the second phase and conclusions.

2. Related work

2.1 Corpus, natural language processing and emotion

Corpus is defined as an availability of suitable data in machine-readable authentic texts [3] and is designed to be the representative of a particular language. Xiao [4] states that corpus size is hard to define since it depends on the purpose of the research study, and corpora play an important role nowadays in natural language processing (NLP) research and computational linguistics as well as linguistic studies, particularly corpus linguistics.

Linguistically, emotions have strong linguistic choice that expresses people voice and tone of the text [5]. Emotion analysis is increasingly important due to digital communication. Online system and Artificial Intelligence program can be a support system for people interaction and emotions. In light of this sophisticated communication, suffice it to say that great challenge of automatic emotion recognition and detection tools by focusing on emotion words and nonverbal data is increasing. Recent research has focused on emotion corpus building with multi-perspective annotation by following emotion theoretical idea of emotion and its causes [6]. Russo et al. [7] built a corpus of Italian newspaper articles annotated with emotion key words and emotion cause phrases. Many studies on Chinese corpus construction have been developed. Gui et al. [8] constructed emotion-cause-annotated corpora for Chinese. Chen et al. [9] adopted a rule-based approach based on linguistic patterns to detect emotion causes in the annotated Chinese corpus. Also, Gui et al. [10] presented a question-answering approach to emotion cause extraction.

2.2 Thai Corpus and Emotion

Several corpora in Thai have been built and made available to the scientific and technological community, such as National Electronics and Computer Technology Center - NECTEC. The applications of emotional expression and interaction have been in existence. For example, e-mental healthcare for auto-screening and detecting symptoms of people with depressive disorder through Facebook Messenger called *Jubjaj Bot*, was developed by a Mahidol University research group [11].

That being said, hardly have any studies on emotion corpus and emotion wordnet been conducted by Thai researchers. As a matter of fact, Thai Wordnet building, and construction have been proposed. For example, Leenoi et al. [12] specified a standard for building Thai Wordnet with a bi-directional translation method. Akaraputthiporn et al. [13] constructed the wordnet by using a bi-directional translation approach. Thoongsup et al. [14] proposed Thai wordnet construction by applying the semi-auto alignment method. A few studies have investigated emotion in the field of cognitive linguistics by analyzing metaphor and emotion words in Thai texts. For example, Tawichai [15] used cognitive semantics to describe basic emotion words derived from physiological effect which contributed to meaning extension in Thai. Conceptual metaphor was utilized mainly as an approach to studying metaphor and emotion in Thai, e.g. emotion metaphor [16], anger metaphor [17], fear metaphor [18], suffering metaphor [19], happiness metaphor [20], and love metaphor [21]. Collectively, these studies on emotion metaphor in Thai were influenced by the work of Kovecses [22], [23]. Notwithstanding such influence, there is a dearth of research on building emotion corpus associated with basic emotion classification in Thai context.

2.3 Emotion and Sentiment analysis

Concepts of emotion are historically and differentially considered. Various terms have been used in the semantic domain of emotion, such as sensation, affection, feeling, mood, and sentiment. In NLP research, sometimes emotion and sentiment are interchangeable. As such, emotion when conceived from the polarity evaluation perspective as positive, negative, or neutral attitude is called sentiment. Thus, studies focusing on attitudes and evaluation are called sentiment analysis [5].

Areas of study directly involving sentiment analysis and emotion analysis run the gamut from social sciences, psychological and cognitive science to computer science. Despite the common concern with feeling and affection, emotion and sentiment have differing foci. As stated above, sentiment analysis mainly targets the attitudes on polarity of positive, negative, or neutral. Most of Thai emotion recognition applications are sentiment analysis in this sense. Conversely, emotion analysis focuses, by and large, on human feelings and emotions, particularly basic and the circumplex model. Although emotion analysis and sentiment analysis deal with the evaluative and expression of language, sentiment analysis is insufficient in appropriately addressing specific purposes in regard to emotion classes, such as fear, anger, sadness and so on. This is especially when it comes to the task for mental healthcare intervention development.

To the best of our knowledge, there is no research that systematically categorizes basic emotion in Thai or classifies emotion words to create emotion corpus. Furthermore, the review of previous studies published in Thailand and other countries suggests that our work, which tracked verbal and nonverbal data to consider emotions aspects of Thai people, is in all probability the first research on emotion recognition and classification.

Notwithstanding the general classification of emotional texts into six basic emotions, categorization of verbal emotions into such emotion classes has been deplorably ambiguous. Given the unclear categorization as mentioned, one of our main tasks is to initiate the guideline of emotion categorization to more accurately classify and annotate emotion in Thai.

Additionally, emotional text, such as depression or depressive disorder text, should be a main resource for exploring how emotion words work. There is no depression corpus from people with depressive disorders available in the public domain as of now. This lack of corpus presents us with the opportunity to introduce a corpus, comprising diaries and interviews of 40 depressed students from the previous research of Angkapanichkit et al. [2], which were augmented by four depression-experiencing authors of autobiographic books to facilitate further research and development. In addition, this paper provides a practical explanation of the steps involved in creating a specialized corpus and wordlist with tagged emotion. The following is intended as an introductory, step-by-step, practical guide for those interested in creating a verbal and nonverbal emotion corpus.

3. Steps to verbal and nonverbal emotion corpus creation

The main objective of this paper is to introduce steps to create emotion corpus in Thai involving both verbal and nonverbal corpus, supplemented by the tentative guideline for emotion categorization with an emphasis on the Thai context. Our project is divided into two phases dealing with different data processing methods/techniques. The first phase is concerned with an overview of emotion in Thai concepts and data resources—both verbal and nonverbal, followed by an exploration of Thai lexicon, wordlists and specific texts related to basic emotion along with audio-visual data to set a primary standard guideline of emotion classification. The second phase revolves around constructing verbal and nonverbal emotion dataset and setting a standard guideline by tracing another emotional text of people on the university campus. The overview of steps for creating emotion corpus of our first phase is shown in Figure 1.

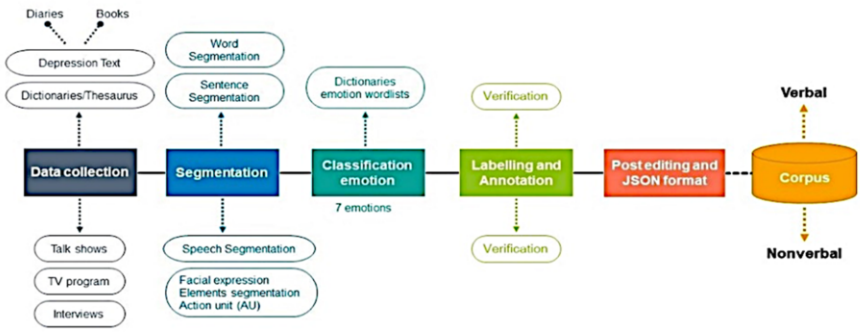


Figure 1. The steps of emotion corpus creation on the first phase

3.1 The first step: Data collection

As for data collection, initially data were divided into linguistically meaningful units. The lowest level represented the lexicon or words from Thai standard resources, i.e., dictionaries and thesaurus, complemented by phrases and sentences or utterance in conversation consisting of one or more words. Normally, words, phrases, and sentences, constituting texts, are the fundamental units of language processing for segmentations and tagging such as parts of speech tagging. As a very first step, we explored the number of words whose meanings are related to emotion. Such words were collected based on Thai vocabulary database, and figured out how we would be able to classify them into basic emotions. That is, the guideline system for both verbal and nonverbal emotion database should be appropriately established in this stage.

Given the steps discussed above, verbal data, i.e., Thai vocabulary, were purposively collected from two main resources. The first resource was from the standard dictionaries and thesaurus. All of them are the main sources of references to Thai standard and daily language. Name list of dictionaries and thesaurus used in our project and the number of emotion wordlists are shown in Table 1 below.

Table 1. The number of word count and emotion wordlists in Thai Dictionaries and Thesaurus

Title	Cover picture	Word count	Emotion Word
Khlangkham (Thai Thesaurus) (2019 version) [TT]		25000	3750
Dictionary of the Royal Institute (2011 version) [RI]		43000	2132
Dictionary of Thai New Vocabulary by the Royal Institute volume 1 (2010 version) [NV-1]		1000	574
Dictionary of Thai New Vocabulary by the Royal Institute volume 2 (2009 version) [NV-2]		1000	238
Dictionary of Thai New Vocabulary by the Royal Institute volume 3 (2010 version) [NV-3]		1000	346
	Total	**71000**	**7040**

The second resource of verbal texts related to emotional expression were collected from narratives and interviews of people with depression. Topic-oriented texts in this project were carefully and systematically collected since they dealt with emotional expressions. To begin with, verbal texts about the personal life of depressive disorder were selected. Text genre can be defined as autobiographical narratives which were

published and unpublished alike. All texts were produced by Thais who have experienced depression, such as college students, actors, businessman and so on.

Nonverbal data were collected from public resources e.g., TV talk shows program and movie star interviews, taking into consideration relevant facial expressions with emotional speech situations. All speech and interviews were transcribed into conversational style of text by using speech-to-text of Google ready program. Nonverbal data were considered as multimodal texts, or audio-visual texts. Text genre is defined as speech in interaction with specific emotional expressions. Nonverbal data were tracked by means of both verbal speech unit and facial expression unit, respectively.

Data selection

The data of Thai vocabulary from five main dictionaries and thesaurus were labelled as emotion words by the first two Thai native speakers. Eventually, the number of predefined words that contained emotions was 7,040 words out of about 71,000 words in total. The numbers of word count and emotion wordlist are shown in Table 1.

It should be noted that emotion corpus creation in this project is a small but well-controlled corpus. Therefore, selected emotional texts from narratives, interviews, and short essays as well as autobiographic books were included. All texts of 40 depressed student narratives and interviews were sampled from the corpus of the previous research project on *Language, Communication and Depression* [2]. Moreover, four published books written by Thai authors, who were experiencing depression, were categorized as the genre of autobiography. Totally, in the first stage, verbal text related to the topic of depression consisted of 19,940 sentences, and 212,170 words contained in the data selection. All the text lists with numbers of word and sentences are shown in Table 2.

Table 2. Depression text with word count and numbers of sentences

Text list	Word count	Numbers of sentence
Sam Wan Dii Sii Wan Sao (Three Good Days, Four Sad Days)	22,878	2,000
Depression Diary	30,415	2,860
Manus Suem Sao kap Rueng Lao Sii Khao Dam (People with Depression and the Black-and-White Story Telling)	41,741	3,881
Tai Roy Kreet (It's all about the Cut)	26,469	2,566
Narratives and interviews of 40 depressed students	90,669	8,633
Total	**212,170**	**19,940**

3.2 The second step: Segmentation

Word and sentence segmentation could not be independent from one another. As a typologically isolating language, the Thai language poses a challenge to the segmentation task since there is no unobscured sentence boundary. Tokenization of words, and utterance (for the case of nonverbal data) known as tokens, is explicitly marked in the speaking system with most frequently used final particles such as *kha* (female polite particle), *krap* (male polite particle), and the topic marker such as determiner *nii*, *nan*, or punctuation of pause. For the writing system, sometimes there is

no demarcation between word boundaries and phrases, particularly noun groups and noun phrases.

In the first start of segmentation, all text data were cleaned and manually segmented by the researchers and two Thai language experts. We primarily used the program as an automatic tool for word segmentation. The tool required input raw data in text file (.txt format) with its metadata appearing on the beginning of the text file initiated by the symbol %. The text was read by program tool and part-of-speech tagging (POS tagging) using ORCHID program. All tagged files can be retrieved by the users. Example of .txt file format is shown for a word segmentation and POS tagging in Picture 1.

```
%ประเภทงานเขียน: หนังสือ
%ชื่องานเขียน: มนุษย์ซึมเศร้ากับเรื่องเล่าสีดำ
%ตอนที่: 1
%ผู้เขียน: นายพินต้า
%เพศของผู้เขียน: ชาย
%เนื้อหา: โรคซึมเศร้า
%ปีที่พิมพ์: 2563
%สำนักพิมพ์:13357
%ISBN: 978-616-93544-1-3
%จำนวนหน้า:224

มนุษย์ซึมเศร้ากับเรื่องเล่าสีดำ
มนุษย์      NCMN
<S>ซึมเศร้า         NCMN </S>
กับ         RPRE
เรื่องเล่า  NCMN
<S>สี       NCMN
ดำ          VATT </S>
EOS
```

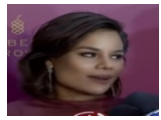
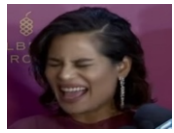
Picture 1. Example of .txt file with word segmentation and POS tagging by ORCHID program

3.3 The third step: Emotion classification

Action Unit and Facial Expression in Speech Situation

The concept of emotion as people's thought and experience from Ekman [24] is instrumental for our project since we have taken into account both verbal and nonverbal emotion corpus. We employed Ekman's classification of six basic emotions [24] namely *anger*, *fear*, *disgust*, *joy or happiness*, *sadness*, *surprise*, and *neutral* with the addition of the class *contempt* and *other emotions* as expressed in the text. This is because they were unable to be reliably categorized into one of the basic classes. Ekman [24] argues that humans have a set of facial expressions of basic emotion as a biological response in interaction. We can describe human emotion through facial movement by using the Facial Action Coding System (FACTS) to annotate the components of facial muscle movements called 'Action units' (AU) [24]. Following the FACTS as our primary guideline, facial expressions from audio-visual data were classified into seven basic emotions. Table 3 shows the examples of facial expression emotion as classified by Action Unit (AU) along with speech situations of a Thai movie star when interviewed on TV entertainment news as talking about her little child in school. The utterances and key words were translated into English to facilitate international readers' understanding.

Table 3. Example of emotion classification by using Action Unit

Utterance	Time	Key words	Emotion	Sub-category	AU
She said she wanted to be the leader of her class in school	0.00.32	She/said/ I/am/the leader	Neutral	neutral	 AU6+AU12
On that day, she was the only one in the class	0.00.36	She/was alone/the class	Joy	humor	 AU6+AU12

Constructing guidelines, using semantic primes

For the verbal emotion guideline, we determined emotion semantic primes by applying Natural Semantic Metalanguage (NSM) [25], [26], lexical semantics [27] and cognitive semantics of conceptual metaphor theory [27-29]. These semantic approaches were employed to distinguish word meanings and to interpret metaphorical meanings of words related to emotion. For example, the semantic relations of antonym *Ron* 'hot' and *Yen* 'cool' can signal metaphorical meanings of emotion. The conceptual metaphor of temperature HOT IS ANGER is normally interpreted by Thai people. For example, the compound word *Hua Ron* (literally *Hua* 'head' *Ron* 'hot') conveys a metaphorical meaning of anger. Conversely, the word *Yen* can signal the emotion of happiness and neutral when used as a compound word such as *Chai Yen* (*Chai* 'heart' *Yen* 'cool'), which means calm or patient, which is categorized by semantic feature of basic emotion 'neutral'. When appearing in the expression '*Yuu Yen Pen Suk'* which has the literal meaning as 'being good, feeling happy', *Yen* in this sense is classified as emotion 'happiness'. Further, the adverbial phrase of '*Yen Waap*' (metaphorical meaning as 'feeling scared') or sentence-like *Mue Yen* (literally *Mue* 'hand' *Yen* 'cool') signals a physical response to scare. In the light of this, the word '*Yen'* can be classified as containing various emotions depending on its contextual meaning.

This ambiguous use of emotion words necessitated an investigation into the semantic primes as well as semantic features of each emotion class to draw the standard guideline of emotion classification. In the first stage of classifying emotion, a tentative guideline was introduced to the experts and researchers to screen and group emotion words from our data sources. By applying semantic primes of emotions [26], we proposed Thai semantic features of basic emotions as our tentative guideline for emotion classification as follows:

Emotion	Semantic Primes
ANGER	[BAD] [DO] [THINK] [KNOW] [HAPPEN] [I] [GOAL] [THING/SOMEONE/EVENT] [NOT] [LIKE] [TIME-past/present]
FEAR	[BAD] [THINK] [KNOW] [DO] [HAPPEN] [I] [THINK] [THING/EVENT/SOMEONE] [TIME-past/present/future]
SADNESS	[BAD] [THINK] [DO] [HAPPEN] [I][THING/EVENT/SOMEONE] [PART-behavior] [[NOT] [LIKE]] [TIME-past]
JOY	[GOOD] [THINK] [DO] [KNOW] [HAPPEN] [I] [WANT-desire] [THING/SOMEONE/EVENT] [TIME-past/now/future]
SURPRISE	[GOOD] [BAD] [[NOT] [THINK]] [KNOW] [DO] [HAPPEN] [I] [PERCEIVE] [THINK/SOMEONE/EVENT] [ACT-response] [TIME-present]
DISGUST	[BAD] [PERCEIVE-see/hear/smell] [DO] [HAPPEN] [I] [THING/SOMEONE] [ACT-response] [TIME-past/present]
NEUTRAL	[KNOW] [DO] [HAPPEN] [I] [THING/SOMEONE/EVENT] [PERCEIVE] [ACT-control] [TIME-past/present/future]

As stated above, we categorized the features of seven basic emotions by extracting its semantic features of each emotion into unreducible semantic primes which were represented by capital letters in the square bracket. The primes signified semantic domain of words and sentences in contextual usage associated with each emotion. We employed Thai emotion semantic primes to classify words, phrases, sentences or utterances related to the emotion class. This provided the solution to the aforementioned problem of ambiguous meanings and multiple interpretations in the data.

For example, the word *Kruek Krom* ครึกโครม' literally means loudly or noisily. The Thai dictionary [RI] defines the word as excitement which can be classified into two emotions, joy and surprise, depending on the context of use. If you know something good happening when using the word '*Kruek Krom'*, this word belongs to the 'Joy' class. If you do not think about something happening before and you do not know whether it is good or bad, this word is classified as 'Surprise'. Contrary to the dictionary meaning, we found this word contains different senses, for example 'ทำอะไรกัน เสียงครึกโครมเลยนะ' (What are you doing? You are making a very loud noise.). This sentence signaled two senses; that is, you think someone made a bad thing you do not like because you do not like loud noise, or you assumed that the loud noise led you to think that there would be something bad happening. Given this difference sense, this word was related to the 'Anger' emotion.

This emotion semantic primes would be valuable for corpus material. Once our lexicon can be identified and put into emotion class, it will be listed as emotion wordlists, and then will be grouped into emotion classification.

3.4 The fourth step: Annotation and Label

The specific texts of depression and nonverbal facial expressions with speech in interaction were labelled and annotated. This step led to the association with basic emotions, including textual context annotations such as persons, events, causes, action etc. The complete annotation guidelines would be available when the verbal and nonverbal emotion lexicon were completely classified. All corpus was labelled manually by the researchers, Thai language experts and a native Thai volunteer.

Annotation and Verification

In doing corpus annotation, we realized that language, cognition and culture affect how emotion is perceived and expressed in an interaction. We carefully selected three natives to label: 1) Thai language experts, 2) a researcher and 3) a native volunteer. Every annotator was required to be (1) a native Thai speaker, and (2) knowledgeable about and understandable of communication à la Thai style. These requirements enabled the annotator to be able to observe facial expressions in addition to recognizing the emotion words appropriately. Moreover, to ensure consistency, we had each annotator label the full corpus including wordlists in Thai dictionaries and our lexicon. Before annotating the corpus, the annotators were briefed and given a document of guidelines for emotion classification. The document provided theoretical background of emotion categorization, a number of examples and wordlists. When all the labelling and annotation were completed, the process of verification by means of interrater rating was pursued, thereby contributing to the reliability of the corpus.

3.5 The last step: Post editing

To ensure that our output data of all annotated emotion and classified wordlists were appropriately identified and completed as much as possible, all data had to be edited. Three Thai linguistic experts were invited to scrutinize the results of all annotated data and emotion words classification. Some ambiguity and overlapping of emotion in sentences, phrases or words were detected and clarified. After fully edited, all data were transformed into JSON format at the end. A computer scientist was needed for this latter part.

4. Conclusion and Future Work

We have introduced our two-phase research project on emotion corpus creation in the Thai language. The main purpose of this project was to construct emotion corpus available for AI development. Another purpose was to set the standard guideline for verbally and nonverbally categorizing emotion language by using linguistic-based knowledge such as cognitive semantics for contributing to a clear definition of basic emotions in the Thai context. What we have described is an on-going process of creating corpus at the first phase. Steps for working have been developed a primary guideline to establish a suitable way to classify seven basic emotions for both verbal and nonverbal data. This project is a multi-knowledge based which varied from the textual oriented approach of cognitive semantic, discourse analysis to applied linguistics such as paralinguistics, to psychological and to the computer-science approach. Our dataset was

lexicon gathered from the main resources of Thai language references, i.e., dictionaries and thesaurus, along with topic-oriented texts of depression. Nonverbal data of the first phase comprised the public audio-visual text from TV programs to find the tentative guideline of categorizing and classifying facial expressions within speech emotion situations. This made our project different from other previous projects on emotion-corpus and facial expression identification.

To achieve a succinct classification of emotion corpus, we had to collect verbal and nonverbal data from other resources. In the second phase, nonverbal data were collected from volunteers who underwent the emotion-inducing procedure conducted by a psychologist. Facial expressions with AU labelling and speech categorization were recorded via video clips. Verbal data were then collected from topic-related-emotion texts of short essays and interviews of students, lecturers, and staff of the Thai university campus under the emotion screening test of the Depression, Anxiety and Stress Scale - 21 (DASS-21) test. These data were, in fact, being collected. Future research should be conducted to enrich the corpus with a more important number of sentences and words as well as more annotations. Thai language experts and Thai native speakers were instrumental in annotating and editing corpus that would strengthen the contribution of emotion corpus in Thai natural language processing (NLP) and AI in the near future. The newly created Thai emotion corpus in this project would be released as an open-source dataset to be available for running both verbal and nonverbal corpus classification for the development of emotion recognition for AI Ready City project.

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