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# Teaching Thai Language Literacy: Proposed of Using Speech Recognition Technology Techniques to Detect Read Aloud in Thai Tonal Conjugation for Primary Education Students

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## Abstract

*This academic article has objectives were 1) to study the techniques in data analyzing of speech recognition systems techniques to detect reading aloud skills in Thai tonal conjugation for Primary Education Students, and 2) to study the effect of speech recognition systems techniques to detect reading aloud skills in Thai tonal conjugation for Primary Education Students. Sample group in this research were 30 Primary Education Students in Grades 4 – 6 of Wat Na Klang School in Nakhon Sawan Province, Thailand. Research tools was speech recognition systems techniques to detect reading aloud skills in Thai tonal conjugation.*

*Results showed that,*

*1) the three techniques involved in sound analysis consisted of Spectrogram Sound Wave Change Techniques, Wavelet Transform Audio Format Conversion Techniques, and two sets of data similarity comparison techniques named Dynamic Time Warping (DTW). The researchers used three techniques in analysis and comparison for making the more similar to the sound signal than using a single technique to analyze.*

*2) the effect of using speech recognition system to detect reading aloud skills in Thai tonal conjugation showed results of pronunciation practice and compared the similarity of audio signals that after using the technique in 5 analytical times, the largest average result was 93.52 Percent, the least average result was 87.75 Percent, and the total average result was 90.66 Percent.*

**Keywords: Sound Wave, Thai Tonal Conjugation, Speech Recognition, Primary Education Students**

## Introduction

Thai language is the official language that all elementary school students must read and write according to the indicators and learning content in the core learning of the Basic Core Curriculum, B.E. 2551, presented that “Thai language is a national identity, a cultural treasure that creates unity, and enhances the personality of the nation to be Thai person, and also a tool for seeking information and experiences to develop knowledge as well as to use in career development is a valuable treasure worthy of preservation and continuation of the Thai nationality forever” (Ministry of Education, 2017). Thai letters, although they are fixed sound marks but there are many words that have problems with how to pronounce them. In the practice of reading Thai words, if the learner does not have the correct skills and understanding of tonal conjugations, it will cause misunderstandings and confusions, resulting in miscommunication or misunderstandings due to changes in the language. Tonal sounds in reading have the effect of changing the meaning of words (Nakorn, 1981).

Learning any language, whether a native language or a foreign language, starts with learning the listening and pronunciation skills first, and whether language acquisition is successful or not depends on your ability to lead. to use effectively able to communicate successfully in the use of language for communication, pronunciation is very important (Naiyaphat, 2005). Hence, learning Thai language of Thais' Primary Education Students showed the significance that most of them have problems in Reading and Writing especially Tonal Diversion and Tonal Writing (Watcharasukhum, 2013; Thodthankun and Chansuwan, 2016; Dipatee and Narapongkasem, 2018; Cholkerkkait, 2018; Poosawad, 2018; Mardiyusoh and Tornram, 2020)

At present, Information Technology is playing a wide role in various fields, especially education by applying in various ways including the use of computer-assisted teaching, mixed media systems, information systems, database systems, and the Internet, etc. Due to the impact of advances in Information Technology, the format or method of educational management has changed from the traditional education that was based on teachers or teachers as the center of learning. knowledge to individual education, focusing on technology to promote self-learning, emphasizing morality and ethics (Malaiwong, 1997). Speech Recognition is a technology that allows a computer to function like a human cognition process and to correctly identify interests. For example, it enables a computer to recognize information from a sound and a computer digitizes it which can be analyzed or processed (Korpanyapipat, 2015)

The importance above shows that in learning management, teachers or instructors need to train learners to develop more clear practical skills through practicing pronunciation skills and learning skills of students. Students must be studied as a guideline for future student development. The researcher therefore to investigate the model and techniques in data analyzing of speech recognition systems to enhance practice of reading aloud skills in Thai tonal conjugation for Young Learners

### Objectives

- to study the techniques in data analyzing of speech recognition systems techniques to detect

reading aloud skills in Thai Tonal Conjugation for young learners

- to study the effect of speech recognition systems techniques to detect reading aloud skills in Thai Tonal Conjugation for young learners.

### Research Methodology

This research titled the effects of effects of using speech recognition technology techniques to detect read aloud in Thai Tonal Conjugation for young learners. There are operating procedures as follows:

#### Procedures for Conducting Research

- Survey to collect information on problems in learning Thai Tonal Conjugation. by using a questionnaire on the opinions of teachers and students
- Learn about speech recognition technology
- The sound obtained from the data collection of the sample was analyzed and compared with the conversion of each sound technique.
- Apply each technique to analyze the results.

#### Scope of Research

- Demographic scope and target group in collect sound data.
- The population used in the research was primary school students of Wat Na Klang School Academic Year 2021
- The target group used in this research were 30 students in grades 4 - 6 at Wat Na Klang School (in Nakhon Sawan Province, Northern Part of Thailand), academic year 2021.

#### Scope of Content

The data used to survey the students' problems with reading aloud in Thai Tonal Conjugation consisted of words that were tonal formless, the tonal sounds match the tonal form, and the tone that does not match the tonal form in total of 100 words, and researchers collected sound data using 35 words that the students often mispronounce which categorized into 15 formless tones, 12 tones matching the tonal form, and 12 tones. whose sound does not match the tonal form 8 words.

#### Tools used in Conducting Research

##### Working Data

The student's sound data obtained by collecting sound data using 35 words that students often mispronounced.

### Data Analysis Program

- Working equipment
- Computer
- Mobile phone
- Techniques used in data analysis
- Spectrogram technique
- Wavelet Transform Technique
- Dynamic Time Warping (DTW) Technique
- Microsoft Excel
- Any Video Converter Ultimate Program
- Free MP3 Cutter Program
- Praat Program
- MATLAB program
- Audio data

### Method of Collecting Data

- Step 1: Explore the problem of tonal words that are often mispronounced.
- Step 2: After surveying, collect sound data using 35 words that students often mispronounce.
- Step 3: To collect audio data, researchers asked for cooperation from students in the Thai language department. There was 1 male and 1 female each to collect the prototype sound data and collect the sample group's sound data by practicing the pronunciation for a total of 5 times.
- Step 4: Analyze the sound data and compare it with the original sound to find a prototype in the same age range of students in Grades 4 - 6 before analyzing the data.

### Data Analysis

Researchers conducted the research in work steps are as follows:

- Step 1: Understanding the Problem, researcher has studied the relevant research and has studied the problem of reading aloud and Thai Tonal Conjugation, and study techniques used for analyzing various audio signals, Sound Wave Dynamics, Spectrograms, Wavelet Transforms, Analogy of Sequences that differ in time or

- speed, Dynamic Time Warping (DTW).
- Step 2: Data Understanding, researchers studied the available data and considers the feasibility of data analysis. In collecting the data, researchers surveyed the students' problems with reading aloud and changing the Thai Tonal Conjugation as in Table 1, Table 2 and Table 3 as follows:

**Table 1 A Tonal Formless**

Thai Words			Tonal Conjugation
คา (Ka)	มา (Ma)	เดือน (Duan)	Mid Tone' (Tone 1)
ขาด (Kard)	จาก (Jak)	หลบ (Lop)	Falling Tone (Tone 2)
ขาด (Kard)	แรด (Rad)	พุด (Pood)	Falling Tone (Tone 3)
รัก (Rak)	ปัก (Pak)	พืด (Fad)	High Tone (Tone 4)
หนา (Nar)	ขา (Kha)	สวย (Suay)	Rising Tone (Tone 5)

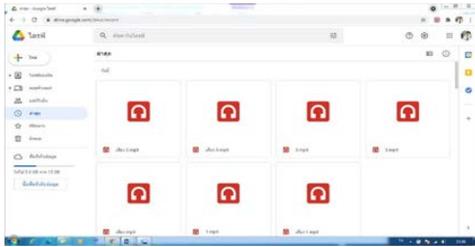
**Table 2 A Tone that Matches the Tonal Form**

Thai Words			Tonal Conjugation (Writing Form)	Tonal Conjugation (Sound Form)
ขา (Kha)	สง่า (Sa-Nga)	หมี (Mee)	Falling Tone (Tone 2)	Falling Tone (Tone 2)
ก้อง (Kong)	จ้า (Jar)	ป้า (Par)	Falling Tone (Tone 3)	Falling Tone (Tone 3)
โต๊ะ (Toh)	แก๊ส (Gas)	กัก (Kak)	High Tone (Tone 4)	High Tone (Tone 4)
แต้ว (Taew)	จ้า (Jar)	ปืม (Pim)	Rising Tone (Tone 5)	Rising Tone (Tone 5)

**Table 3 A Tone that do not Matches the Tonal Form**

Thai Words				Tonal Conjugation (Writing Form)	Tonal Conjugation (Sound Form)
ว่า (War)	ค่า (Kar)	ง่า (Ngar)	โล่ง (Long)	Falling Tone (Tone 3)	Falling Tone (Tone 3)
ยื้อน (Yorn)	พ้อง (Pong)	ฟ้า (Fah)	กำ (Kam)	High Tone (Tone 4)	High Tone (Tone 4)

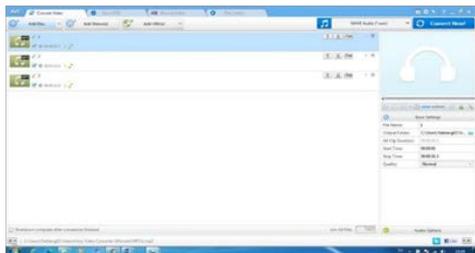
Step 3: Data preparation is the importing of raw data that has been converted into data that will be used in the next step, as shown in Figure 1.



**Figure 1 Sample of Audio Data from Data Collection**

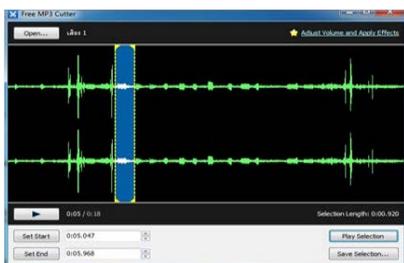
Selecting the appropriate variables for analysis and converting all variables to the same format to prepare the data for modeling can be divided into 3 sub-steps as follows:

- Convert the resulting audio data into a .wav audio file using Any Video Converter Ultimate as shown in Figure 2.



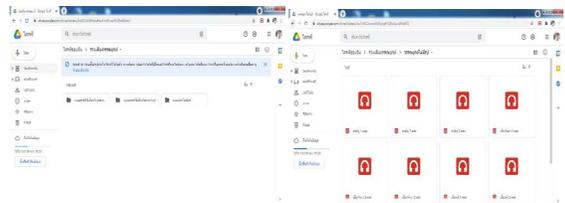
**Figure 2 Convert the Audio to .wav File Format**

- Cut the converted audio into words by the researcher using Free MP3 Cutter program as shown in Figure 3.



**Figure 3 Cutting Audio into Words**

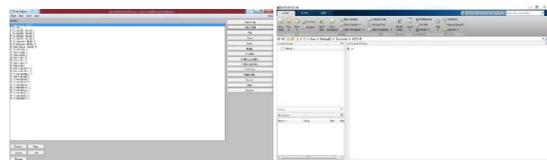
- Grouping the tonal words in each form and the sounds that have been cut into words and analyzed as shown in Figure 5.



**Figure 4 The Tonal Groups in Each Picture and the Sounds that have been Cut into Words**

Step 4: Data analysis is the use of transcribed and cut-to-word audio data to compare sound similarity analysis with the following steps.

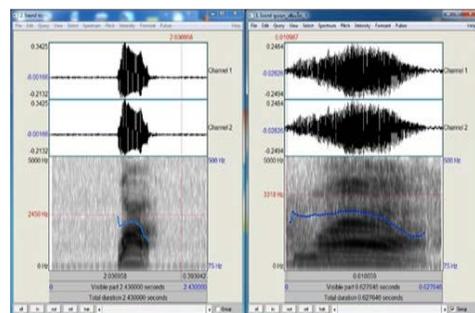
- The researcher chose Praat and MATLAB programs for data analysis as shown in Figure 5.



**Figure 5 Praat and MATLAB Programs**

Researchers took the data from the audio that has been converted and cut into words to analyze the techniques as follows: Spectrogram technique to consider the position of time, shape and size of the signal together with Wavelet Transform audio format conversion technique to convert the signal before comparing the similarity of the two data sets by using the Dynamic Time Warping (DTW) technique to measure the similarity between the sound signals.

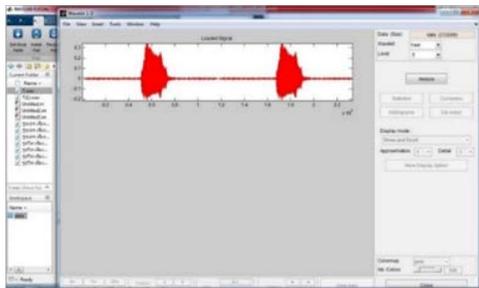
Researchers took the converted and cut audio data and analyze by the Spectrogram technique to determine the position of time, shape, and size of the signal as shown in Figure 6.



**Figure 6 Spectrogram Analysis**

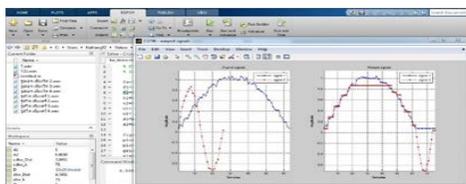
Researchers took audio data that has been converted, and cut audio data, and analyzed with

Wavelet Transform technique by compressing the original audio signal and sample to convert the existing signal accordingly before comparing the similarity of the data as shown in Figure 7.



**Figure 7 Analyze Wavelet Transform**

Similarity analysis of 2 sound signal sets by using Dynamic Time Warping technique to find similarity of 2 data sets as shown in Figure 8.



**Figure 8 Similarity Analysis of Dynamic Time Warping Sound Signal Sets**

### Deployment Phase

In this paper, a speech recognition system technique was used to help in detection of reading aloud and translating Thai Tones for young learners. Researchers used various techniques to analyze sound signal sets which could be applied with teaching other languages to help in problem solving with reading aloud and also serve as a guideline for developing a system or technology that helps in teaching language in the future.

### Results of Data Analysis

Researcher presented the research results according to the following objectives:

Part 1 to study the techniques in data analyzing of speech recognition systems techniques to detect reading aloud skills in Thai Tonal Conjugation for young learners

**Table 4 Sound Similarity Results used by each Technique together in the Analysis**

Analytical Techniques			Sound Signal Resemblance (Percent)
Spectrogram	Wavelet Transform	Dynamic Time Warping	
✓			67.32
✓	✓		81.14
✓	✓	✓	93.84

From Table 4 shows the similarities of the sound signals used by each technique together. The first technique used was the sound wave spectrogram technique to determine the position of time, shape and size of the sound signal. 67.32 Percent, the next order will be the use of sound wave spectrogram technique together with Wavelet Transform sound format conversion technique to convert the existing sound properly to have a sound signal similarity equal to 81.14 Percent, the last order will be using the Wavelet Transform technique to optimize the existing signal before using the Dynamic Time Warping (DTW) technique to measure the similarity of two audio data sets. Together, each technique was able to compare and show that the sound similarity was 93.84 Percent higher.

Part 2 to study the effect of speech recognition systems techniques to detect reading aloud skills in Thai Tonal Conjugation for young learners.

**Table 5 Results of Pronunciation Training and Comparison of Sound Signals**

No.	Results of Pronunciation Training and Comparison of Sound Signals (Number of Times)					Average 5 times (Percent)
	1	2	3	4	5	
1	86.21	88.22	87.12	89.03	90.50	88.22
2	90.39	90.93	92.68	93.79	93.82	92.32
3	91.87	92.79	93.76	93.82	93.84	93.22
4	86.48	88.87	87.62	89.94	90.97	88.78
5	87.95	89.97	90.59	91.42	93.14	90.61

6	88.91	89.17	90.29	91.52	93.74	90.72
7	88.98	89.95	91.98	92.80	92.88	91.31
8	85.98	86.45	89.01	91.21	92.42	89.01
9	85.98	88.87	87.96	90.94	91.98	89.15
10	92.95	93.22	93.79	93.82	93.84	93.52
11	86.98	88.06	89.91	91.95	92.91	89.96
12	90.92	92.23	92.98	93.79	93.88	92.76
13	86.91	89.91	90.30	91.52	93.74	90.48
14	86.98	88.16	89.91	91.92	92.95	89.98
15	90.95	93.22	93.79	93.82	93.84	93.12
16	85.56	85.82	87.19	89.18	91.02	87.75
17	86.91	89.91	91.38	92.82	93.84	90.97
18	85.98	88.66	89.41	91.89	92.88	89.76
19	84.98	87.66	89.21	91.82	92.41	89.22
20	87.50	89.85	90.88	91.82	93.84	90.78
21	89.57	90.85	91.89	92.98	93.82	91.82
22	85.50	86.62	87.19	90.23	92.71	88.45
23	86.98	88.66	89.21	91.92	92.82	89.92
24	90.97	91.97	92.98	93.82	93.84	92.72
25	89.98	90.93	91.68	92.89	93.62	91.82
26	85.50	86.62	89.19	90.33	92.61	88.85
27	89.92	91.86	92.98	93.79	93.84	92.47
28	85.98	86.66	89.11	91.51	92.82	89.22
29	83.71	89.91	91.38	92.82	93.84	90.33
30	90.12	91.76	92.98	93.79	93.84	92.49
Total Average						90.66

From Table 5 the results of the pronunciation exercises and the analogy of the sound signals were compared. After using various techniques together to analyze 5 times, the average result is 93.52 Percent, the lowest mean is 87.75 Percent, and the total mean is 90.66 Percent.

### Discussions

The results of a study on the data analysis techniques of the speech recognition system to detect reading aloud and translating Thai tones for young learners found that the techniques involved in sound analysis consisted of Sound Wave Transformation technique, Spectrogram technique, Sound Wavelet Transform technique, and Dynamic Time Warping (DTW) similarity comparison technique by using the researcher have used various techniques together for analysis and comparison. A greater resemblance to an audio signal than using a single analysis technique.

From the study of sound similarity by using various techniques together to analyze the similarity of the sound signal, the first technique used is the sound wave spectrogram technique to determine the position of time, shape and size of the signal to have a signal similarity. Votes accounted for 67.32 Percent. The next step will be to use the sound wave spectrogram technique together with the sound wavelet transform technique to convert the existing signal accordingly to have a sound similarity equal to 81.14 Percent. Sound wave spectrogram in combination with Wavelet Transform to optimize the existing signal before using Dynamic Time Warping (DTW) to measure the similarity of two audio data sets. By using each technique together, the analyzer can compare and show that the sound signal similarity is 93.84% higher. Translating sounds to homogeneous sounds for data analysis and is a method that has

been effectively applied to speech recognition and signal processing ([Korpanyapipat, 2015](#)).

The results of using the speech recognition system to help practice reading skills in Thai tone conjugation for primary school students found that the results of practicing pronunciation and comparing the similarity of sound signals after using various techniques were analyzed 5 times. The highest average result was 93.52 Percent, the lowest average result was 87.75 Percent, the total average result was 90.66 Percent. The results of using the speech recognition system to detect reading aloud and translating Thai Tones for young learners found that the results of the pronunciation practice and the comparison of sound signals were similar. After using various techniques together to analyze 5 times, the average result is 93.52 Percent, the lowest mean is 87.75 Percent, the total average is 90.66 Percent, consistent with teaching Thai language at present. with the use of technology and innovation in teaching and learning to help solve problems as well as to develop learners to learn effectively ([Sinthaphanon, 2009](#)). This result related to [Malangpoo et al. \(2022\)](#) finding which showed that using speech recognition technology help teachers in detect the error of pronunciation in teaching Chinese speaking of Thai students.

### Conclusions

This research were to study the techniques in data analyzing of speech recognition systems techniques to detect reading aloud skills in Thai Tonal Conjugation for young learners and to study the effect of speech recognition systems techniques to detect reading aloud skills in Thai Tonal Conjugation for young learners, results shows that the technique in used for detect students' Thai Tonal Conjugation consisted of three techniques which involved Spectrogram Sound Wave Change Techniques, Wavelet Transform Audio Format Conversion Techniques, and Dynamic Time Warping (DTW). After experiment phase by using 30 students, it showed that the developed Speech Recognition Technology techniques can be used to detect students read aloud in Thai Tonal Conjugation. Moreover, the next phase, researchers will develop the application which using this technique as the systems to detect how students read aloud and record in database.

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