


การสังเคราะห์เสียงพูดภาษาไทยสำหรับคำที่ไม่รู้จัก  
Morphological Derivative for Unknown Words  
in  
Thai text-to-speech Synthesis



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# Speech Processing Applications



- Interactive Voice Responding
- Telephone Banking
- Information over the Phone
- Internet Phone
- Digital Mobile Phone
- Computer Telephony Integration (CTI)
- Call Processing
- Voice Messaging & Mail
- Digital Transmission Channel
- Tele-marketing
- Tele-medicine
- Text-to-Speech
- Speech Recognition
- Digital Speech Coding
- Talking Dictionary
- Talking Computer
- Tool for Disabilities
- Future Man-Machine Interface
- Toys
- Etc...

# Thai Text-to-Speech

## ■ The Problems

- Unknown Words
- Transliteration
- Proper noun

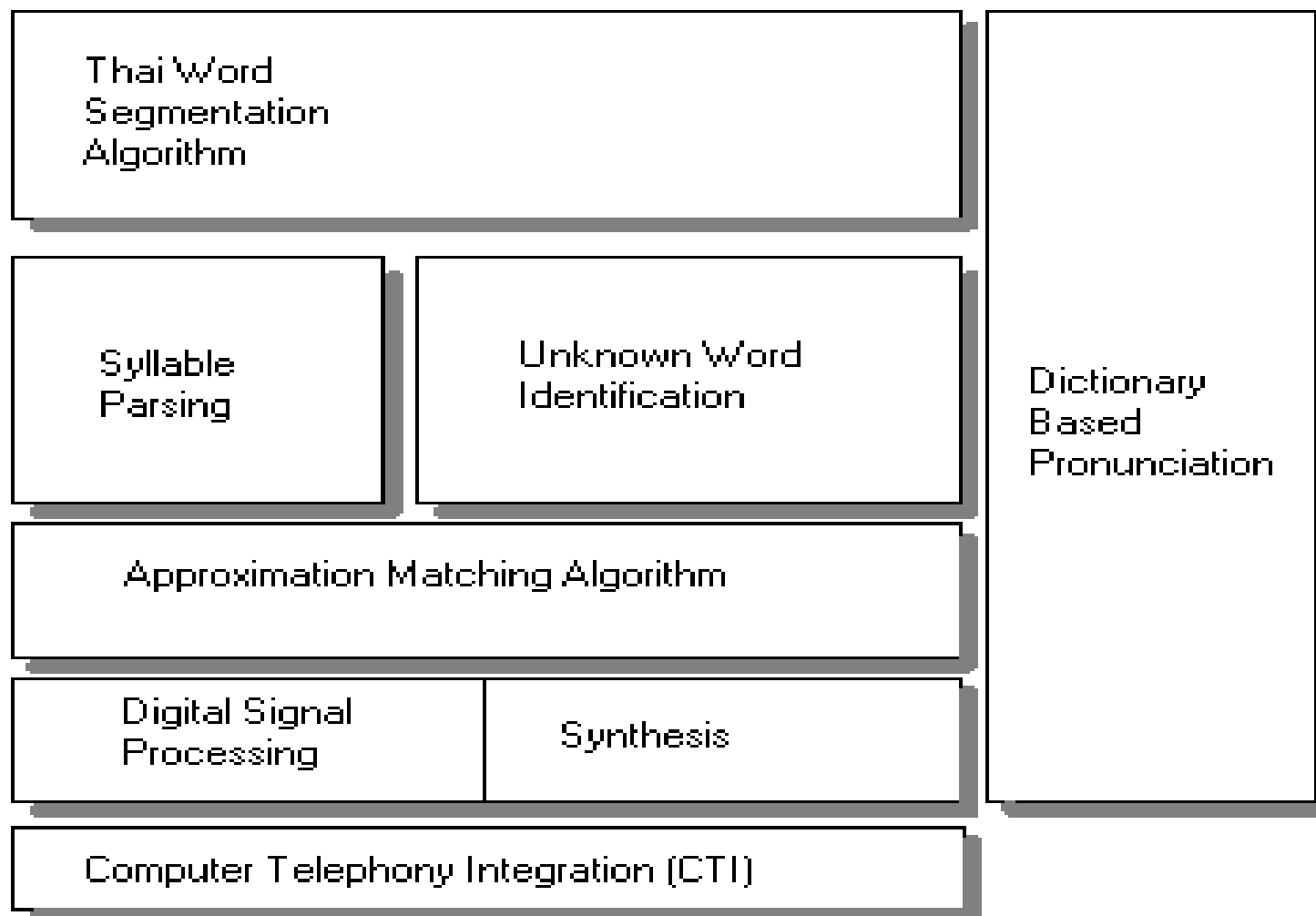
## ■ The Architecture

- Thai Word Segmentation
- Dictionary Based Pronunciation
- Morphological Derivative for Unknown Words
- Signal Processing
- CTI

## ■ Morphological Derivative

- A Fuzzy Logic Approach
- Unknown Word Identification
- Syllable Parsing
- Approximation Matching Algorithm for Thai
- Variable Precision

# The Architecture



# Thai Word Segmentation, Syllable Parsing and Unknown Word Identification Algorithm

## ■ Thai Word Segmentation

- Longest First Matching
- Trie Based Dictionary

## ■ Syllable Parsing

- Rule based
- 16 rules developed according to the: “หลักภาษาไทย”, อ. กำชัย ทองหล่อ”

## ■ Unknown Word Identification

- Prior word + Garbage
- Garbage + Consequence Word
- Prior word + Garbage + Consequence Word
- Measure the best combination via Syllable Parsing Algorithm
- The garbage syllable if exist is synthesized as half /ae/ vowel.

# Speech Unit Selection Using Approximation Matching Algorithm

## ■ Fuzzy Value Calculation

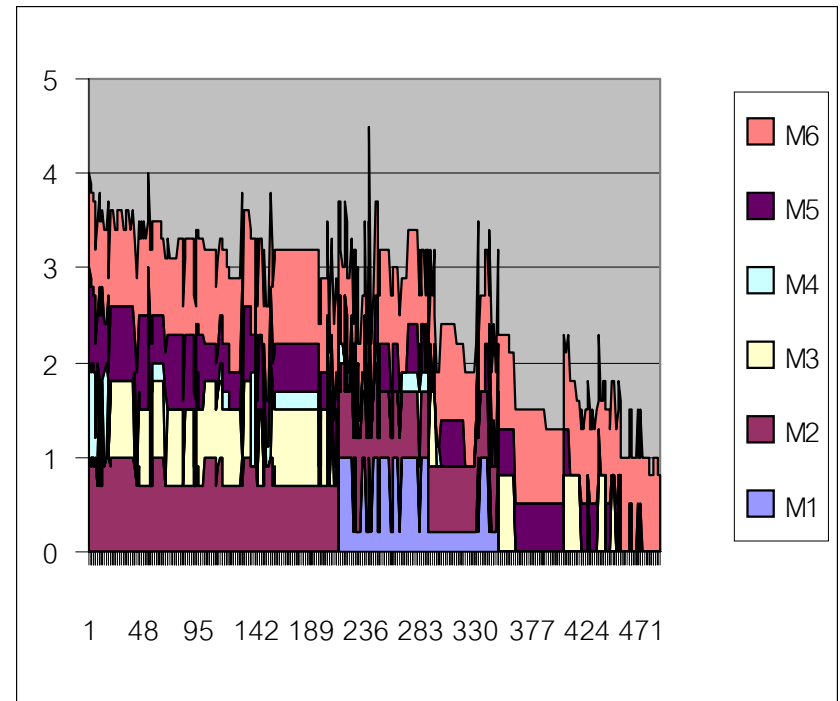
- $vF = \{M1, M2, M3... M6\}$
- M1: Preceding Vowel
- M2: Consonant
- M3: Consecutive Consonant
- M4: Vowel
- M5: Following Consonant
- M6: Tone

## ■ Formula

$$vF = \frac{1}{N} \sum_{i=1}^6 \frac{M[i] * W_i}{(W_i * Freq_i)}$$

# Sample Output for “ลีนคอล์น”

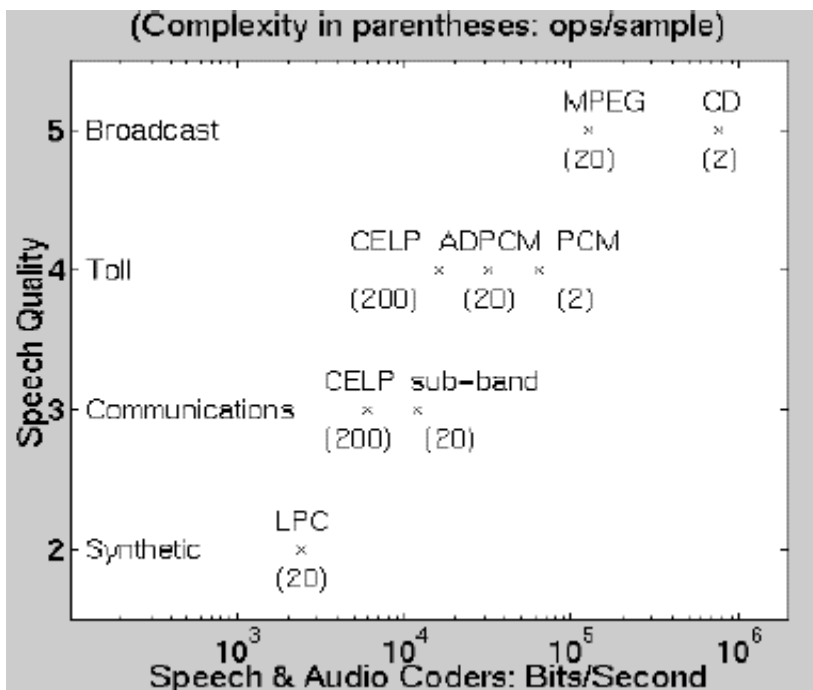
UNITS vF	M[i]
ลิน 0.99	[0 1 0 1 1 0.8]
ลิง 0.92	[0 1 0 1 0.8 1]
อิน 0.88	[0 0.7 0 1 1 1]
สิน 0.88	[0 0.7 0 1 1 1]
คอิน 1.00	[0 1 0 1 1 1]
ชอิน 0.96	[0 0.9 0 1 1 1]
คอิน 0.92	[0 1 0 1 0.8 1]
คอิน 0.92	[0 1 0 1 0.8 1]



# Digital Signal Processing, Synthesis & CTI

## DSP

- *Investigating the Speech Coding Algorithms*



## Synthesis

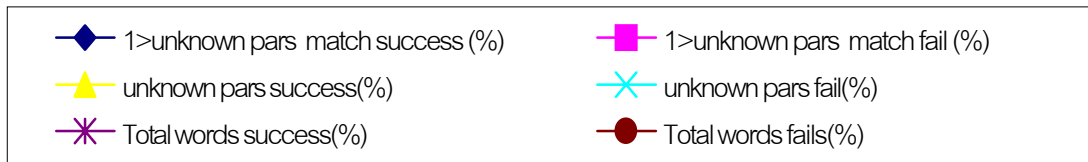
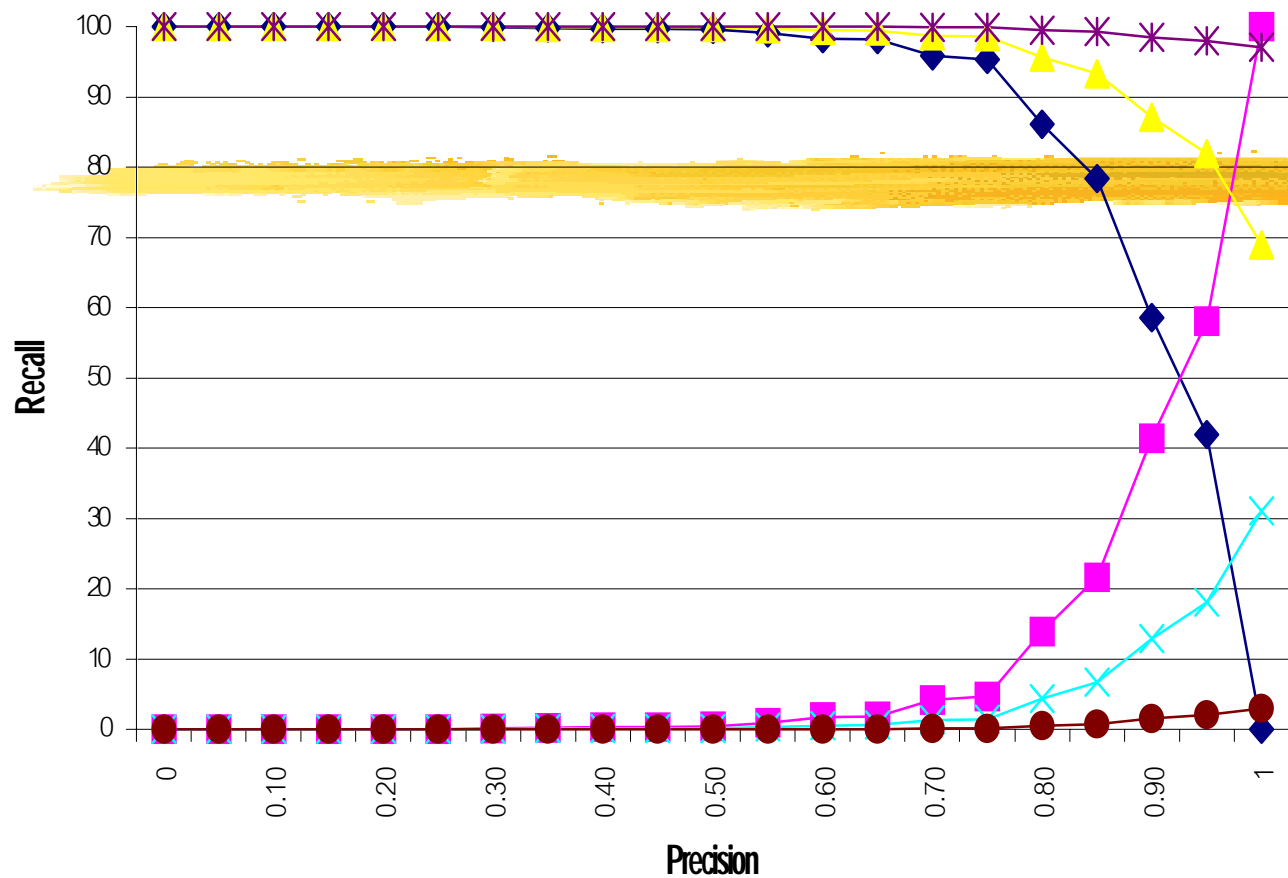
- *Speech Parameter Adjustment*
- Speech Units Concatenation
- *Decoding & Post Processing*
- Speech Output

## CTI

- HW detects the 5th dial tone
- Coupling & interface circuit



# Experimental Result



# Experimental Result Summary



■ Total words: 55,573

■ Average Precision: 99.59%

■ Precision VS Recall  
intersection: 98%

■ Unknown words: 3,249

■ Average Precision: 96.69%

■ Precision VS Recall intersection:  
88%

# *Future Works & Availability*



- *Pronunciation Dictionary Improvement*
- *Evaluation of Speech Coding Algorithms for Thai*
- *CTI Improvement*
  - **Public Availability**
    - <http://www.geocities.com/pisitp>
- **! Thank You for Your Attention !**