



**A Study of Tone Classification for Thai Vowels**

**Miss Li Tan**

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Prince of Songkla University**

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### **Abstract**

The general goal of this thesis is to find a suitable design of tone classifier for Thai speech recognition. First the average magnitude difference function (AMDF) and modified auto-correlation pitch detection algorithms are implemented and both of them provide acceptable results. A 3-layer feed-forward neural network is implemented. The input layer includes four neurons and the output layer consists of five separate units. The classification accuracy is 63%. There are significant confusions between low-tone and rising-tone, high-tone and falling-tone.

Tone-critical-segment, feature setting, scaling, normalization techniques are studied in order to find the best configurations for Thai tone classification. The best performance was obtained using rhythm-tone-critical-segment, 10-feature setting, semi-tone scaling, mean-normalization techniques. There are high confusion among mid, low, and high tones.

Effects of final consonants on tone classification are studied. The final consonants are grouped according to the acoustics knowledge and distribution information for tone classification. The tone group with different final consonant gave the different result. Finally the best average classification performance is improved to 77.13%. In order to utilize the confusion information among the tones to improve the tone classification accuracy, a 2-stage neural network approach is proposed and evaluated. The classification accuracy of 73.36% is obtained.

The contributions of this thesis work are: 1) The study of tone classification is done on a continuous Thai speech database; 2) Configurations of tone features for high performance tone recognition were found; 3) The effects of final consonants on pitch contour are first time studied; 4) Several new approaches for improving the performance of tone classification are proposed and evaluated.