ISOLATED MALAY SPEECH RECOGNITION USING FUZZY LOGIC

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Science (Computer System and Networking).

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Kecerdasan Buatan (AI) adalah salah satu kaedah yang digunakan oleh manusia untuk berkomunikasi diantara manusia dan komputer. Terdapat banyak aplikasi yang dihasilkan dengan menggunakan pendekatan AI seperti diagnosis perubatan, membuktikan teorem matematik dan kenderaan autonomi. Terdapat banyak kaedah dan pendekatan yang telah digunakan oleh penyelidik terdahulu untuk membangunkan sistem pengecaman pertuturan seperti neural network dan Hidden Markov Model. Matlamat penyelidikan ini adalah untuk membangunkan sistem pengecaman ucapan Bahasa Melayu yang terpencil menggunakan kaedah Fuzzy Logic. Kajian ini menumpukan kepada enam perkataan terpencil iaitu *empat (four), lapan (eight), rekod (record), tidak (no), tujuh (seven)* dan *tutup (close)*. Kajian ini juga menumpukan kepada perkembangan peraturan kabur diantara setiap perkataan. Proses penilaian dijalankan berdasarkan kadar ketepatan dan perbandingan diantara kaedah sebelumnya yang menggunakan Hidden Markov Model. Keputusan menunjukkan 75% kadar ketetapan pengenalan suara menggunakan kaedah Fuzzy Logic.

ABSTRACT

Artificial intelligence (AI) is one of the method that human use to communicate between human and computer. There are a lot of applications has been produces by AI approach such as medical diagnosis, proving mathematical theorems and autonomous vehicle. Many methods and approach has been used by researcher to develop speech recognition system such as neural network and Hidden Markov Model. This research aim is to develop a isolated Malay speech recognition using Fuzzy Logic method. This research is focused on six isolated words which is *empat (four)*, *lapan (eight)*, *rekod (record)*, *tidak (no)*, *tujuh (seven)*, and *tutup (close)*. This research is also focused on the development of fuzzy rules between each words. The evaluation process is measured based on the accuracy rate between the previous method using Hidden Markov Model. The result show that 75% speech recognition accuracy rate using fuzzy logic method.

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Va	Total number of success training
Vb	Total number of training

LIST OF ABBREVIATIONS

AI	Artificial Intelligence
ANFIS	Adaptive Neuro Fuzzy Inference System
ANN	Artificial Neural Networks
C	Consonant
CVCs	Consonant-Vowel-Consonants
DSP	Digital Signal Processing
DTW	Dynamic Time Warping
GUI	Graphical User Interface
HMM	Hidden Markov Model
MFCC	Mel Frequency Cepstral Coefficient
SAPI 5.3	Speech Application Programming Interface 5.3
STT	Speech to Text
VQLBG	Vector Qualification using Linde-Buzo-Gray

CHAPTER 1

INTRODUCTION

1.1 Introduction

Speech recognition is one of the method that has been used to communicate between the human and the computer. As the technology become more advanced year by year, speech recognition system has grown a lot to help the human to do their daily activities easier. There are a lot of method that have been use by previous researcher to upgrade and enhance the speech recognition system such as Hidden Markov Model (HMM) by Fadhilah Rosdi (2008), neural networks by Gulin Dede (2009) and Dynamic Multi-Pipeline API by Sirikongtham and Paireekreng (2017). All of this method has their own average rate accuracy depends on the problem that they solved.

Malay language is language that is use as a national language in Malaysia. This language also has been used in Singapore as one of the official language in the country. Others country that also used the Malay language is Indonesia, Brunei and southern Thailand but in different accents and dialects. Not like English words, Malay words does not need lexical stress which means a non-tonal language. Malay language also has been used in English words such as *informasi* (information), *parkir* (parking) and *librari* (library).

In Malay language, there is 37 set of phoneme that are used as phonemic representation. Phoneme is the tiny unit in speech which the substitution of this will affect the meaning. In Malay language has 6 vowels, 27 consonants, 3 diphthongs and 1 for silence. The words have a combinations between vowels (V) and consonants (C). The vowels are divided into two which is vowel backness and vowel height. In each of the words, they have different structures of syllables. The example of structures of syllables is V, CV, VC CVC and many more. The syllables also consist of onset and rhyme but within the rhyme also have a peak and coda.

This research proposed of using fuzzy logic method to increase the performance of speech recognition system. Fuzzy logic is one of the method in Artificial Intelligence that has used widely by researcher to proof and analyse their data according to the rules and steps that they have created. However, Malay speech recognition is still new in our computer industry and technology. This is due to the limitation of finding a related work.

Different people produce different features of speech. Some of them can speak slow, fast, high pitch, low pitch and sometimes whispered. Speed of the speech also can be different for each of them. There are many reasons why the existing system and algorithm is not effective to be use because do not achieve human requirement. Compared to manual method such as written language, it may lead to some difficulties that can affect the recognition process. If the recognition process failed, so the recognition rate also low.

Besides, a lot of speech recognition system has been investigated by previous researcher. There still need a lot of improvement since every system that they implement in different language that have different syntactic and semantic knowledge.

1.2 Problem Statement

Some of the implementation of the system is based on the problem human faced in their daily life. Some of the speech recognition application has been applied in car system by Loh, Boey, and Hong (2017). Loh et al. (2017) has highlight the speech recognition system in the automotive field is implement to control the features in the cars such as controlling the multimedia system using command and output to support the user. The purpose they create this system is to communicate between the system and the person in car. This system also will manage some specific functions in the vehicle such as the command for open and close the door, switch on and off the headlamp and for the signal indicator in the vehicle.

Fadhilah Rosdi (2008), has found that word *empat* and *tutup* has the lowest recognition rate. This is because the word *tutup* is recognize as *tujuh* in the system because of the word structure quite similar to each other's. In Malay language, vowel sound plays an important role to determine the value of the features for each word. The combination of the vowel "u" in between the consonants in the word produces the same values. Therefore, the system recognises *tutup* as *tujuh* due to this problem.

Reem Sabah (2009), the system has been limited to digit 0-9 only. The system used to recognised isolated Malay digits from (0-9) by using ANFIS classifier. The digit is recorded in Malay language without considering any environment factors when recording the sample. They used very small data sets and cannot recognise the continuous speech. The proposed solution result's shows 85.24% average rate which is low and still need more improvement.

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