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PREFACE

The 1st International Conference on Science and Technology for Sustainability 2104 (ICoSTechs2014) is an international event hosted by Faculty of Sciences and Technology, University of Islam Negeri Sultan Syarif Kasim Riau (UIN SUSKA Riau). The purpose of this conference is to provide a forum for researchers, scientists and engineers to exchange new ideas and interact in-depth through discussion with peers from all over the world in the fields of electrical and electronics engineering, informatics, mathematics and industrial engineering. The main goal of this event is to facilitate communications among researchers and practitioners, not only concerning the core areas but also involving multi –disciplinary and interdisciplinary work.

We are grateful to all those who have contributed to the success of ICoSTechs2014. There are a number of parties that have assisted us in organizing this conference become a reality. We would like to thank all authors, participants, faculty members for their participation and support, IEEE Indonesia sections, IIIT (The International Institute of Islamic Though) and BKS PTN Barat (State Universities Cooperation Agency of Western Region). Last but not least, we greatly appreciate the committees and external reviewer's precious and timely reviews. Their expertise is very vital in ensuring the success of this event.

We really hope that all participants benefit tremendously from the conference. Finally, we would like to wish the participants success in the presentations and social networking.

Dr. Alex Wenda
General Chair
The 1st International Conference on Science and Technology for Sustainability 2104, (ICoSTechs2014)
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WELCOME

First, blessing and mercies so we can be here together in this room to healthy condition. And we also convey our syallawat to Prophet Muhammad.

Nowadays, sustainability has been an emerging major issue of the world in order to create a Better Life for the Current and Future Generations. Achieving a Sustainable Development will require changes in many fields, including Sciences and Technologies.

More than one hundred definitions of sustainable development exist, but the most widely used one is the definition from the Brundtland Report of the World Commission on Environment and Development, presented in 1987. It states that sustainable development is the "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Sustainable development promotes the idea that social, environmental, and economic progresses are all attainable within the limits of our earth's natural resources. Sustainable development approaches everything in the world as being connected through space, time and quality of life.

Sustainable development constantly seeks to achieve the social and economic progresses in ways that will not exhaust the earth's finite natural resources. The needs of the world today are real and immediate, yet it is necessary to develop ways to meet these needs that do not disregard the future. The capacity of our ecosystem is not limitless, meaning that future generations may not be able to meet their needs the way we are able to now.

The world's resources are finite, and the growth that is not well-managed nor unsustained would lead to an increased poverty and declined condition of the environment. We owe it to the future generations to explore lifestyles and paths of the development that would effectively balance the progress with an awareness of its environmental impacts. In order to preserve the future, we must appreciate the interconnectedness between humans and nature at all levels. Sustainable Science and Technology practices may help us do this, and through education, research and building awareness, preserving the future is within everyone's reach.

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The 1st International Conference on Science and Technology for Sustainability (ICoSTechs2014) 2014 offers a place and opportunities for researchers and professionals from academic, business, industries, Governments, NGOs, and other sectors to exchange their scientific and technological information. ICoSTechs2014 is also provided for students to present their research papers.

All submissions will be peer reviewed. Accepted papers will be published in the conference proceedings. Selected Paper with a few corrections will be propose to published in **IEEE Xplore Digital Library, TELKOMNIKA Journal (Index by SCOPUS and ISI), and IAES Journals (Institute of Advanced Engineering and Science Journals).**

On this occasion I wish to thank the Rector of UIN SUSKA Riau who had agreed to attend on this occasion and be apride for us on his presence, and we also appeal to the Rector in order to open a international seminar was officially. Thank you very much to **Prof Alexander Jakob Boris Zehnder** over a given time, hopefully on the other occasion we may invite you back. Thanks also to **IEEE Indonesia Section, BKS-PTN Barat – Engineering, International Institute of Islamic Thought (IIIT).**

Thanks to the invitations has the pleasure to present, thanks to the chairman and the entire committee which has prepared this activities, and also to the all of participants in this seminar, hopefully be beneficial to all of us. Congratulations and hope that with the implementation of this seminar makes our role in the world of science and technology more clearly visible, so our presence is felt by the community. So any remarks from me, finally I apologize if there are words that are not in place. Congratulations.

Dra. Hj. Yenita Morena, M.Si
Dean
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ICoSTechs 2014 Schedule

Wed, October 22nd 2014
Conference Day

07.30 – 10.10	Opening Ceremony
	Coffee Break
10.10 – 12.20	Session I Presentation from Keynote Speaker
	Prof. Zehnder Alexander Jacob Boris
	Moderator: Kunaifi, S.T, M.Sc
13.30 – 15.30	Session II Paralel Presentation
	Moderator Room A : Ismu Kusumanto, M.T
	Moderator Room B : Rika Susanti, S.T, M.Sc
	Coffee Break
15.30 – 16.00	Closing Ceremony

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Noise Cancelling for Robust Speaker Identification Using Least Mean Square

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Abstract – **This study focused on noise cancelling using Least Means Square (LMS) for robust speaker identification. Noise cancelling can be used to overcome speaker identification difficulties in recognizing noisy voices. This study used the LMS on data preprocessing. Based on experimental results, it can be concluded that speaker identification using LMS at data preprocessing produces higher accuracy than without using LMS. The highest accuracy of data that using the LMS is 84.64% whereas the data without using the LMS only 2.11%.**

Keywords* – *least means square, noise cancelling, speaker identification

I. INTRODUCTION

Speaker identification is part of the speaker recognition that aims to find out who is speaking with an existing voice [1]. Speaker identification can be done because no voice among people same. This is because the shape of the vocal tract, rhythm, intonation, pronunciation patterns, choice of vocabulary and so forth in humans are different [2]. This studies focused on the speaker identification of the noisy voice. It is interesting to study because most of the research on speaker identification has obtained good accuracy on the voice that intentionally is made without noise, but not on the voice that full of noise [2].

One of the main parts of speaker identification is feature extraction. The extraction of the features is needed to reduce unnecessary information on the speech signal captured by the sensor and converting important information from the speech signal into a format that is more simple and clear for further processing. One of the feature extraction method use frequently is MFCC (Mel Frequency Cepstral Coefficient). The working of MFCC is based on the frequency difference can be captured by the human ear so that it can represent how people receive voice signals [3]. MFCC is often used because it is considered a better performance than other methods, such as in the case of a reduction in the error rate. But MFCC has shortcomings, that is not very resistant to noise [4]. Therefore, in this study added ANC (Active Noise Canceling) in the preprocessing of data in order to resolve the issue. This will help MFCC to produce a better feature extraction. This is because the speech signal produced by the ANC is the speech signal that has undergone a reduction in noise. So the purpose of this study to create a model of speaker identification that robust to noise can be achieved.

ANC is an approach to noise reduction using a

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secondary noise source that destructively removes unwanted noise [5]. ANC method used in this study is the Least Mean Square (LMS). This method was first proposed by Widrow and Hoff [6]. The LMS method becomes very popular because of the low complexity and capabilities that promise.

Another important part in the speaker identification is the making of the codebook. Codebook is voice prints produced through a training of data [7]. In this study, Self Organizing Map (SOM) is used as a training algorithm. SOM successfully applied to high-dimensional data [8], which is the traditional method may not be able to do so. The results of MFCC might produce a high-dimensional data, depending on how many coefficients are determined in the process of MFCC. This is the reason for choosing the SOM as a method to make codebook.

II. Research Method

Broadly speaking, this study consisted of two parts. Illustration of these two parts can be seen in Figure 1. The first part is the making of the codebook. Making codebook performed on training voice data for each speaker. The voice data are not given the noise before. After that, the feature extraction process done by using MFCC. Vectors result from the MFCC process clustered by using SOM. Vectors of the SOM cluster results are used as a codebook.

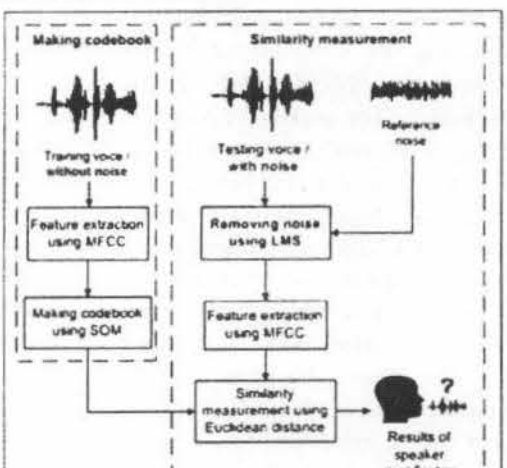

Fig. 1. Ilustration of research method

The second part is the similarity measurement. In this part the data used is testing voices. The voice data are given noise. Noise used in this study is white noise with various values below 6.5 dB. After that, the data preprocessing is done by eliminating noise using the LMS method. Then MFCC process performed to produce a feature extraction. Not like the process of creating codebook, vectors of MFCC are not processed by using SOM, but directly be measured the distance to the codebook by using Euclidean distance. The speaker that their codebook vectors get the smallest distance to the vectors of test voices determined as speakers representing voice input.

III. Voice Data

Voice data used is ever used by Reda [9] in their study. The voice data consists of 83 speakers, which are divided into 35 female speakers and 48 male speakers. The speakers are Indian citizens of different backgrounds. Each speaker has 5 voice files in wav format. The voice file length is 1 to 39 seconds. The words that speak by the speaker is a random combination of numbers. Recording is done on the phone using an IVR system (Interactive Voice Response). Sampling rate used is 8000 Hz.

Experiments in this study will be performed in several combinations of parameters. At each combination of parameters one voice files that owned by each speaker will be used to create the codebook. After that, testing performed using all voice data. All voice data used has been removed silent time. This is done 5 times so that all voice files for each speaker ever be the data to create the codebook. For each experiment are calculated the resulting accuracy. After all the experiments carried out in a combination of particular parameters, then computed the average of accuracy. This accuracy is used as the level of speaker identification ability.

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IV. MEL FREQUENCY CEPSTRAL COEFFICIENT (MFCC)

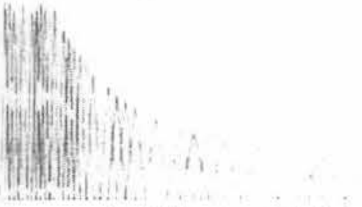

Fig 2 Illustration of filter bank

This study uses MFCC designed by Slaney [10]. This MFCC is chosen because have been having ERRed (Equal Error Rate) and DCFopt (Decision Cost Function) are lower than other types of MFCC [11]. This MFCC implements 40 filters that handle frequencies from 133 Hz to 6854 Hz. The filter is divided into two parts, 13 pieces of filter of linear space (200-1000 Hz) and 27 pieces of logarithmic space (1071-6400 Hz). The collection of the filter is called filter bank. Illustration of filter bank can be seen in Figure 2.

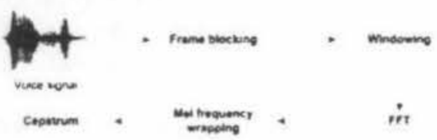

Fig. 3. Illustration of MFCC stages

Based on Figure 3, in general MFCC has 5 steps. The first stage should be done are dividing the incoming signal into several frames. This stage is called the frame blocking. The second step is smoothing each frame by using hamming windows. This is done to eliminate signals that are not continuous on the frame. The third step is changing all the frames from the time domain to the frequency domain. This is done by using FFT (Fast Fourier Transform). The fourth step transforms the frame into a mel scale. This is conducted by calculating $\log_{10}$ result multiplication of frames and filter bank. The last step returns the voice frames from the frequency domain to the time domain using DCT (Discrete Cosine Transform).

V. SOM (SELF ORGANIZING MAP)

SOM (Self Organizing Map) was first offered by Kohonen [12]. SOM or also known as Kohonen, is one type of ANN (Artificial Neural Network), which is unsupervised learning systems. SOM assumes a topological structure between the cluster units, it is run by a human brain but is not present in any other ANN. SOM network only consists of two layers, namely the input layer and output layer. Each unit in the input layer is connected to all units in the output layer.

TABLE I EXPERIMENTAL PARAMETERS

Parameter	Value
MFCC	
frame length	12.5 ms
overlap	0.4
coefficient	20
SOM	
number of clusters	9, 16, 25, 36, 49, 64, 81 and 100
radius of neighborhood	3
topology	hexagonal
LMS	
learning rate	0.1, 0.3, 0.5, 0.7 and 0.9

In SOM training should be determined how many clusters to be produced, the type of topology, and the radius of neighborhoods. Afterwards, make units in the output layers as many as clusters desired and collate based on the type of topology. The unit is a vector that has the same dimensions with the dimensions of the data. Initialize weights on each unit with random values. For each input data, find the smallest distance to the unit as BMU (Best Matching Unit). Distance measuring method used in this study is the Euclidean distance. Update the BMU and its units are still neighbors. Updating the weights is done to make unit closer to the data. Neighbors are updated depending on the type of topology and adjacency radius that previously selected. The following formula for the update unit:

$$w_{ij}(new) = w_{ij}(old) + \alpha[x_i - w_{ij}(old)] \quad (1)$$

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where w is the weight of the unit in the output layer, x is the input data and α is the learning rate.

VI. LMS (Least Mean Square)

ANC method used in this study is the LMS (Least Mean Square). LMS is applying the gradient descent. This method was first proposed by Widrow and Hoff [6]. Steepest descent, which is one method that implements gradient descent actually been very good to generate optimal weights, but this method requires a true gradient at each step. LMS can overcome these shortcomings because LMS can instantly estimate the gradient at each step [6]. LMS algorithm is briefly as follows:

1) Create a filter and initialization the weight (w) of the filter. Specify a value of the learning rate (α).

2) Perform steps 3 to 5 if there is an incoming voice signal (d).

3) Calculate the anti-noise using the following equation:

$$y_i = \sum_{j=1}^{M} w_j u_j \quad (2)$$

where y is anti-noise and u is reference noise.

4) Calculate the residual signal using the following equation:

$$e_i = d_i - y_i \quad (3)$$

where e is residual signal and d is a primary voice signal. Residual signal is the result of noise cancelling.

5) Change the weights using the following equation:

$$w_j(new) = w_j + 2\alpha e_i u_j \quad (4)$$

VII. Experiments and Results

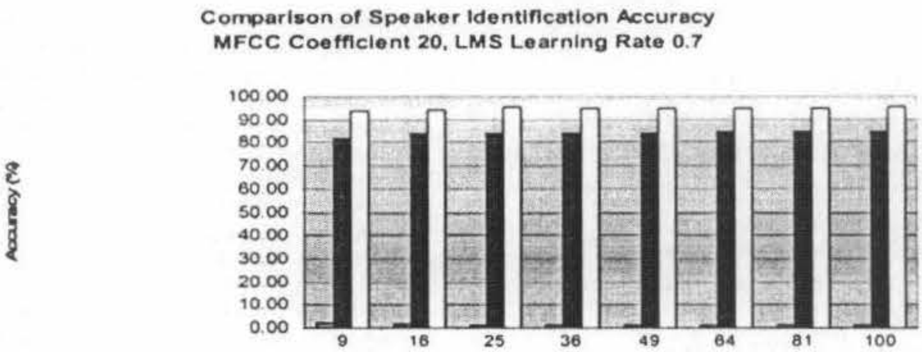
Results and analysis presented in this section are a summary of experiments using various combinations of parameter values. The parameters used are listed in Table 1.

A. Effects of Using LMS

This section about comparing the accuracy of speaker identification on noisy voice between uses and did not use the LMS on the preprocessing of data. Experiments were chosen to represent this part is experiment with learning rate of LMS is 0.7. Graph of experimental results can be seen in Figure 4.

Accuracy of speaker identification did not use the LMS in preprocessing of data is very low, which only reached 2.11%. Accuracy becomes greatly increased after using the LMS in data preprocessing, which reached 84.64%. This result shows that the noise removal by the ANC does not eliminate the human voice characteristics. Despite that, the accuracy of speaker identification is still lower than voice without noise, the difference is about 10%.

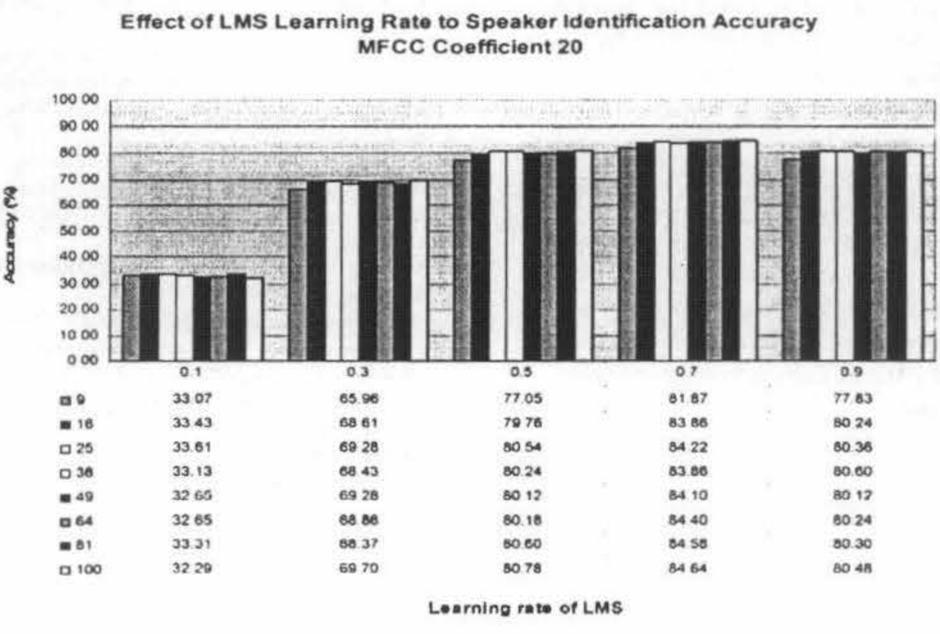
Figure 4 shows that the data processed by LMS that the greater the number of cluster SOM tends to increase the accuracy of speaker identification. Despite that, the resulting improvement is not significant. Differences between the highest accuracy (100 clusters) and the lowest accuracy (9 clusters) is only 2.77%. Increasing the number of clusters will increase the dimension of the data which will increase the complexity. This will make the calculation time of speaker identification becomes increasingly longer. Due to the increase of the number of clusters did not produce a significant improvement of accuracy, so it is suggested to choose a relatively low cluster number.



	9	16	25	36	49	64	81	100
With noise / Without LMS	2.11	1.87	1.27	0.96	1.02	1.14	0.96	0.84
With noise / With LMS	81.87	83.86	84.22	83.86	84.10	84.40	84.58	84.64
Without noise / Without LMS	93.37	94.10	94.94	94.82	94.88	94.88	94.70	94.94

The number of SOM clusters

Fig. 4. Comparison of speaker identification accuracy



	0.1	0.3	0.5	0.7	0.9
9	33.07	65.96	77.05	81.87	77.83
16	33.43	68.61	79.76	83.86	80.24
25	33.61	69.28	80.54	84.22	80.36
36	33.13	68.43	80.24	83.86	80.60
49	32.65	69.28	80.12	84.10	80.12
64	32.65	68.86	80.18	84.40	80.24
81	33.31	68.37	80.60	84.58	80.30
100	32.29	69.70	80.78	84.64	80.48

Learning rate of LMS

Fig. 5. Effect of LMS learning rate

B. Effects of LMS Learning Rate

This experiment to see the effect of learning rate (LR) LMS to speaker identification accuracy. The experimental results presented here are the result of experiments on MFCC coefficients 20. The effects of LR can be seen in Figure 5.

Figure 5 shows, using LR 0.1 the accuracy of speaker identification is low, only 33.61%. At LR increased to 0.3, the accuracy has increased but is still below 70%. At LR increased to 0.5, the accuracy has reached greater than 70%. At LR increased to 0.7, all the speaker identification accuracy has been above 80%. If LR is increased again, the accuracy is decreasing. Increased LR did not increase the data dimension. Therefore advisable to choose the LR that produces the best accuracy. From the experiments

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performed best LR value obtained is 0.7.

VIII. Conclusion

Based on the experiments conducted it can be concluded that speaker identification for the noisy voice that using LMS at data preprocessing produces a higher accuracy than without using LMS. The difference is very significant, the highest accuracy using LMS is 84.64% while the highest accuracy that without using LMS only 2.11%.

Increasing the number of SOM clusters successfully increases accuracy but does not proportional with increase of complexity. Increasing LR on the LMS until limits certain value can increase the accuracy of speaker identification but the accuracy fell back after passing the limit value. From the experimental results obtained best LR is 0.7.

In the future studies are advised to trying the noise that comes from the real world to know the effect on speaker identification. So robustness techniques offered in real applications can be known.

Acknowledgment

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