

Speech Recognition System Based on Wavelet Transform and Artificial Neural Network

Engy R. Rady¹, Ashraf H. Yahia², El- Sayed A. El-Dahshan³, and Hatem El-Borey⁴

¹ Basic Science Department, Faculty of Computers and Information,
Fayoum University, El Fayoum, Egypt
era00@fayoum.edu.eg.

² Physics Department, Faculty of Science, Ain shams university,
Cairo, Egypt
ayahia@sci.asu.edu.eg.

³ Egyptian E-Learning University EELU-33 Elmesaha Str. El-Doki El-Gezia Cairo
seldahshan@eelu.edu.eg

Abstract

For the past several decades, designers have processed speech for a wide variety of applications ranging from mobile communications to automatic reading machines. Speech recognition reduces the overhead caused by alternate communication methods. Speech has not been used much in the field of electronics and computers due to the complexity and variety of speech signals and sounds. However, with modern processes, algorithms, and methods we can process speech signals easily and recognize the text. This paper presents an expert speech recognition system for isolated words based on a developed model of Discrete Wavelet Transform (DWT) and Artificial Neural Network (ANN) techniques to improve the recognition rate. The data set was created by using English digits from zero to five and other nine words (spoken words) which was collected from four individuals in various time intervals. The feature vector was formed by using the parameters extracted by DWT. We have employed Daubechies 4-tap (db4) wavelet for the experiment. The feature vector was produced for all words and formed a training set for classification and recognition. Forty-four features were feed to feed forward backpropagation neural network (FFBPNN) for classification. The performance of the developed system was evaluated by using speech signals. The rate of correct classification was about 98.9 % for the sample speech signals.

Keywords: *Discrete Wavelet Transform, Speech Recognition, Feature Extraction, Artificial Neural Network.*

Published In: Egyptian Computer Science Journal

References

- [1] Ayadi, M.M.H.E., Kamel, M.S., Karray, F.: Survey on speech emotion recognition: Features, classification schemes, and databases. *Pattern Recognition*(2011) 572-587
- [2] Patel, I., Dr. Srinivas Rao, Y., Speech Recognition using HMM with MFCC- An Analysis using Frequency Spectral Decomposition Technique, *Signal & Image Processing : An International Journal(SIPIJ)* , 1(2) (December 2010).
- [3] Trivedi, N., Dr. Kumar, V., Singh, S., Ahuja, S., and Chadha, R., Speech Recognition by Wavelet Analysis, *International Journal of Computer Applications* 15(8) (February 2011) 27–32.
- [4] Avci, E., and Akpolat, Z.H., Speech recognition using a wavelet packet adaptive network based fuzzy inference system, *SinceDirect*, vol.31, no. 3, 2006, pp 495- 503.
- [5] Siafarikas, M., Ganchev, T. & Fakotakis, Wavelet packets based speaker verification. In *Proceedings of the ISCA speaker and language recognition workshop – Odyssey’2004*, Toledo, Spain, May 31–June 3, (2004) 257–264.
- [6] Saito, N. —Local feature extraction and its application using a library of bases. I Phd thesis, Yale University (1994).
- [7] Buckheit, J. B. and Donoho, D. L., *WaveLab and Reproducible Research*, Dept. of Statistics, Stanford University, Tech. Rep. 474 (1995).

- [8] Wesfred, E., Wickerhauser, V., Adapted local trigonometric transforms and speech processing. *IEEE trans. on Signal Proc.* 41 N.12 (1993) 3596-3600.
- [9] Visser, E., Otsuka, M. & Lee, A spatio-temporal speech enhancement scheme for robust speech recognition in noisy environments, *Speech Communication.* 41 (2003) 393–407.
- [10] Alotaibi, Y.A., Investigation of spoken Arabic digits in speech recognition setting, *Informatics and Computer Sciences* 173 (1–3) (2005) 105–139.
- [11] Lampinen, J., Oja, E., Fast self-organization by the probing algorithm, In *Proceedings of the International Joint Conference on Neural Networks (IJCNN)*, volume II (1989) 503-507, Piscataway, NJ. IEEE Service Center.
- [12] Haykin, S. *Neural Networks: A comprehensive Foundation*, Prentice Hall, 1999.
- [13] Canal, M.R., —Comparison of Wavelet and Short Time Fourier Transform Methods in the Analysis of EMG Signals, *Journal of Medical Systems*, (2008)1- 4.
- [14] Pang, J., Chauhan, S., FPGA Design of Speech Compression by Using Discrete Wavelet Transform, *WCECS 2008*, Francisco, USA, 22 - 24 October 2008, pp. 151 – 156.
- [15] *An Introduction to Wavelets*, The original version of this work appears in *IEEE Computational Science and Engineering*, Summer 1995, vol. 2, num. 2, published by the IEEE Computer Society, 10662 Los Vaqueros Circle, Los Alamitos, CA 90720, USA,
- [16] Kadambe, S., Srinivasan, P., Application of Adaptive Wavelets for Speech, *Optical Engineering* 33(7) (July 1994) 2204-2211.
- [17] Vimal Krishnan, V.R., Babu Anto, P., Feature Parameter Extraction from Wavelet Subband Analysis for the Recognition of Isolated Malayalam Spoken Words, (*IJCNS*) *International Journal of Computer and Network Security*, 1(1) (October 2009).