Cairo University

SUBVOCAL SPEECH RECOGNITION USING ENGINEERED FEATURES AND DEEP LEARNING

By

Mohamed Said Elbially Elmahdy

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Biomedical Engineering and Systems

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
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Under the Supervision of

Dr. Ahmed A. Morsy

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Professor
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FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Title of Thesis:

Subvocal Speech Recognition Using Engineered Features and Deep Learning

Key Words:
Surface Electromyography; Deep Learning; Subvocal Speech.

Summary:

In this study we propose an end-to-end deep system for subvocal speech recognition. A single channel surface Electromyogram (sEMG) placed diagonally around the throat is used alongside a close-talk microphone for signal acquisition. The system was tested on a corpus of 20 words. The system classification was independent of the word level but smart enough to learn the mapping function from sound and sEMG sequences to letters, then extracting the most probable word from these letters. Different input signals and different depth levels were investigated using the deep learning model. The system was tested on ten healthy subjects (5 females, 5 males). The proposed system achieved a Word Error Rate (WER) of 9.44, 8.44 and 9.22 for speech, speech combined with single channel sEMG and speech with two channels of sEMG, respectively.

In order to compare the system with the results from literature, a wide range of hand crafted features were extracted and tested with Support Vector machine (SVM) and K-Nearest Neighbors. Results were comparable to those reported in literature.

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Dedication

To my family who never stop supporting me and whose words of encouragement were pushing me to get the best out of myself. Thank you for never left my side.

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Table of Contents