Machine learning based novel real time speech enhancement with A Nested U-Net with different Attention Mechanisms for Hearing aids

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PROPOSAL DETAILS

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Technical Details :

Scheme :	SERB-POWER Grant		
Research Area :	Electrical Electronics & Computer Engineering (Engineering Sciences)		
Duration :	36 Months	**Contact No :**	+918897336595
Date of Birth :	08-Aug-1990		
Nationality :	INDIAN	**Total Cost (INR) :**	16,53,660

Project Summary :

Hearing impaired people are struggling to hear individual speech stream of a speaker in noisy environments like cocktail party. Single channel speech enhancement algorithms are showing great improvement. But still there is lacking in auditory system of attended speaker information in cocktail party environment or in presence of competing speaker. Especially, Older listeners with aged with ensorineural hearing loss (presbycusis) are struggling to understand the speech in case of these type of environments even though they are wearing hearing aid devices. The advanced improvements of deep-learning neural network in speech enhancement area is vastly improved. The Performance of speech en- hancement is still limited because widely used exiting techniques cannot fully exploit contextual information from multiple scales. To address this issue, we propose an Efficient Channel Attention (ECA), self attention (SA) and Time frequency Attention (TFA) with nested U-Net for time domain based monaural speech enhancement. It is an encoder and decoder model with skip connections to improve the information flow. In the proposed method, a new multi-scale assemblage block is proposed to explore large scale contextual information. This way, the benefit of global and local speech features can thus be completely leveraged to increase speech reconstruction abilities. A novel cross-channel interaction can be implemented via the ECA module without dimensionality reduction. In module testing, choose an adaptable kernel size for the ECA improved the network performance significantly. Densely connected dilated DenseNet uses a revolutionary multi-dilated convolution with variable dilation factor in a single layer to simulate many resolutions at the same time. DenseNet improves the growth of a receptive field and a simultaneous modelling of multi-resolution data in a single convolution Layer. By integrating the multi-dilated convolution with the DenseNet design, addresses the aliasing problem that occurs when we naively include the dilated convolution into DenseNet. In this network, we incorporated the denseNet and ECA for better feature extraction and utterance level context assemblage. The effective T-F attention (TFA) module is presented in this work, where a 2-D attention map is produced to provide differentiated weights to the spectral components of T-F representation.

Objectives :

- To study and analyze the DNN based speech enhancement techniques for hearing impaired people
- - To develop and analyze the novel deep learning algorithms for speech enhancement
- - To implement the on Raspberry pi and evaluate its performance
- To compare the results of the proposed algorithms with conventional existing speech enhancement algorithms

Keywords :

Speech enhancement, hearing aid, time-frequency attention, self attention, convolutional neural networks,PESQ

Expected Output and Outcome of the proposal :

- High quality and intelligible speech for hearing aids people - Publishing SCI journals based on the work - Patents

Suitability of the proposed work in major national initiatives of the Government:

Make in India, Startup India, Digital India

Theme of Proposed Work:

Health, Manufacturing

SNo.	CO-PI Details
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