EEG denoising using Artificial Neural Network with different learning algorithms and activation functions

A Dissertation submitted towards the
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Submitted by

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CERTIFICATE

This is to certify that the dissertation title " **EEG denoising using Artificial Neural Network using different learning mechanisms and activation functions**" submitted by **Mr. MANISH KUMAR, Roll. No. 2K14/SPD/08**, in partial fulfilment for the award of degree of Master of Technology in "**Signal Processing and Digital Design (SPDD)",** run by Department of Electronics & Communication Engineering in Delhi Technological University during the year 2014-2016 is a bonafide record of student's own work carried out by him in the academic session 2015-16 to the best of my belief and knowledge the matter embodied in dissertation has not been submitted for the award of any other degree or certificate in this or any other university or institute.

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DECLARATION

I hereby declare that all the information in this document has been obtained and presented in accordance with academic rules and ethical conduct. This report is my own work to the best of my belief and knowledge. I have fully cited all material by others which I have used in my work. It is being submitted for the degree of Master of Technology in Signal Processing & Digital Design at the Delhi Technological University. To the best of my belief and knowledge it has not been submitted before for any degree or examination in any other university.

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ABSTRACT

Electroencephalogram (EEG) recordings often experience interference by different kinds of noise, including white, muscle and baseline, severely limiting its utility. Artificial neural networks (ANNs) are effective and powerful tools for removing interference from EEGs. Several methods have been developed, but ANNs appear to be the most effective for reducing muscle and baseline contamination, especially when the contamination is greater in amplitude than the brain signal. An ANN as a filter for EEG recordings is proposed in this dissertation, developing a novel framework for investigating and comparing the relative performance of an ANN incorporating real EEG recordings. This method is based on a growing ANN that optimized the number of nodes in the hidden layer and the coefficient matrices, which are optimized by different learning mechanism method. The ANN improves the results obtained with the conventional EEG filtering techniques: wavelet, singular value decomposition, principal component analysis, adaptive filtering and independent components analysis. The system has been evaluated within a wide range of EEG signals. The present study introduces a new method of reducing all EEG interference signals in one step with low EEG distortion and high noise reduction.