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TINNITUS

Use of Some Relevant Parameters for Primary Prediction of Brain Activity in Idiopathic Tinnitus Based on a Machine Learning Application

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Abstract

Tinnitus is one of the most common complaints, distressing about 15–24% of the adult population. Because of its pathophysiology heterogeneity, no curable treatment has been attained yet. Even though a neuromodulation management technique based on the tinnitus network model is currently being developed, it has not yet worked because the most involved brain areas still remain unpredictable from the patient's individual clinical and functional profile. A remarkable correlation between tinnitus network activity and the subjective measures of tinnitus like perceived loudness and annoyance and functional handicap is well established. Therefore, this study aimed to develop software for predicting the involved brain areas in the tinnitus network based on the subjective characteristics and clinical profile of patients using a supervised machine-learning method. The involved brain areas of 30 tinnitus patients ranging from 6 to 80 months in duration were recognized by using QEEG and sLORETA software. There was a correlation between subjective information and those areas of activities in all rhythms by which we wrote our software. For verification and validation of the software, we compared and analyzed the results with SPSS data and the receiver operating characteristic (ROC) curves. The findings of this study confirmed the effectiveness of the software in predicting the brain activity in tinnitus subjects; however, some other important parameters can be added to the model to strengthen its reliability and feasibility in clinical use.

Objectives

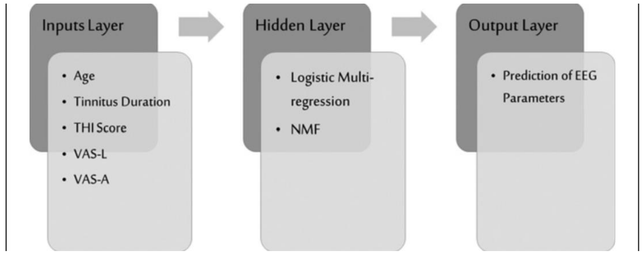
This study aimed to create a model that can predict the patient's neuropathological profile based on correlations extracted from subjective and objective measures of a relatively homogenized tinnitus group. This group was controlled for various important factors such as hearing levels, age range, handedness, neurological wellbeing, and psychological wellbeing, in addition to any medical intervention or medication.

Methods

The involved brain areas of 30 tinnitus patients ranging from 6 to 80 months in duration were recognized by using QEEG and sLORETA software. All of the subjects had normal hearing level or mild hearing loss at mid and high frequencies. The subjective assessments included the scores of VAS-L, VAS-A and THI. There was a correlation between subjective information an those areas of activities in all rhythms by which we wrote our software

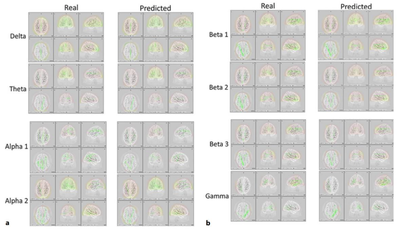
Results

As mentioned previously, important correlations were obtained between primary inputs and outputs. Then, the suitable algorithm was written using supervised machine-learning methods. In the result section, different methods for verification and validation of this algorithm are used and discussed. The first method is making comparison between our algorithm and the SPSS software results that showed the real data from SPSS software were very close to the predicted one of the written algorithms. Second method is plotting the ROC (Receiver Operating Characteristic) that is strong way to evaluate the prediction power of a classifier that this way showed that our software has high accuracy in prediction of relative power of bandwidth of spectrum analysis in QEEG of tinnitus subjects.



Conclusion

Functional connectivity between different regions by real and predicted data that showed very close similarities. So, all of these vérification methods showed that our software based on machine-learning model has high effectiveness in prediction of brain activity in tinnitus subjects.



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