**Real-Time Seizure Detection in an ICU Environment**

*December 2016*

BioSignal Analytics, Inc. and Temple University were awarded an STTR grant from the National Science Foundation for the application of its AutoEEG™ technology to the real-time detection of seizures in an ICU environment. AutoEEG™ leverages validated deep learning techniques and the world’s largest EEG corpus to achieve unprecedented performance in automated EEG analysis.

**Phase I Progress**

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| Description | Files | Sessions | Patients |
| TUH EEG | 38,408 | 16,982 | 10,868 |
| Evaluation Dataset | 1052 | 233 | 50 |

*Data Preparation*

* A semi-automated strategy to label seizures was implemented and identified an evaluation dataset consisting of 50 patients with seizures.
* This dataset was evaluated at Temple University to facilitate algorithm development.
* Twenty (20) neurologists have been identified to annotate the data, and each patient is being annotated by 3 neurologists to address the topic of inter-rater agreement.

*Baseline Technology Evaluation*

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| --- | --- | --- |
| Description | Persyst | AutoEEG |
| Sensitivity | 47.0% | 38.0% |
| Specificity | 80.6% | 78.7% |
| ATWV | +0.0732 | -0.693 |
| Seizure FAs/24 hrs | 44 | 108 |
| Total FAs/24 hrs | 97 | 220 |

* To facilitate standard and comprehensive evaluation of seizure detection, we adopted a methodology developed by the National Institute of Standards and Technology (NIST) known as the NIST STD metric. This metric is especially relevant for measuring seizure detection in an ICU environment because it combines both sensitivity and specificity.
* A commercially available seizure detection tool and an initial version of AutoEEG were evaluated using 30 patients from the evaluation dataset, and a NIST STD score was calculated for both systems.

*Algorithm Enhancement*

* The hidden Markov models and stacked denoising autoencoder of the original AutoEEG is being replaced by a new deep learning network known as long short-term memory (LSTM) networks.

**About BioSignal Analytics, Inc.**

BioSignal Analytics is dedicated to improving the quality of healthcare through the application of state of the art machine learning to provide clinical decision support and expand access to care.

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