Generalized Models for the Classification of Abnormal Movements in Daily Life and its Applicability to Epilepsy Convulsion Recognition

Villar J.R.

Vergara P.

Menéndez M.

De La Cal E.

González V.M.

Sedano J.

The identification and the modeling of epilepsy convulsions during everyday life using wearable devices would enhance patient anamnesis and monitoring. The psychology of the epilepsy patient penalizes the use of user-driven modeling, which means that the probability of identifying convulsions is driven through generalized models. Focusing on clonic convulsions, this pre-clinical study proposes a method for generating a type of model that can evaluate the generalization capabilities. A realistic experimentation with healthy participants is performed, each with a single 3D accelerometer placed on the most affected wrist. Unlike similar studies reported in the literature, this proposal makes use of 5 × 2 cross-validation scheme, in order to evaluate the generalization capabilities of the models. Event-based error measurements are proposed instead of classification-error measurements, to evaluate the generalization capabilities of the model, and Fuzzy Systems are proposed as the generalization modeling technique. Using this method, the experimentation compares the most common solutions in the literature, such as Support Vector Machines, k-Nearest Neighbors, Decision Trees and Fuzzy Systems. The event-based error measurement system records the results, penalizing those models that raise false alarms. The results showed the good generalization capabilities of Fuzzy Systems.

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Epilepsy convulsions recognition

fuzzy rule-based classifiers

Decision trees

Errors

Fuzzy inference

Fuzzy systems

Classification errors

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Error measurements

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Sensitivity and Specificity

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