Detection of epileptic seizures using video data

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Abstract—**Monitoring of epileptic patients is usually done by video/EEG-monitoring which is considered as the golden standard. Due to some disadvantages of this method, this method is not feasible to use in long term home monitoring. Video monitoring provides a solution to this problem as it can monitor the patient in a non-contacting way. An algorithm is developed to detect movement epochs in nocturnal datasets for pediatric epileptic patients. The performance was measured using a three-fold crossvaildation, which resulted in a sensitivity of 1 and a positive predictive value above 0.85.**

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I. INTRODUCTION

Epileptic patients are usually monitored by means of video and EEG, which measures the brain activity. This method, however, is not feasible in a home situation as it is labor intensive to attach the EEG-electrode on the scalp of the patient and a low impedance between the electrode and the scalp is required to have a good acquisition of the EEG. This method also hampers the freedom of movement of the patient and is uncomfortable to sleep with. Making use of only the video data to detect epileptic seizures with a motor component would make the registration easier for the patient and care giver.

With a home monitoring system the seizures can be automatically logged in a database which gives an objective measure of the number of seizures a patient has for the neurologist. With this information the neurologist can follow up the disease in a more accurate way and the medication can be altered.

A second advantage of an automatic monitoring system is that it can give an alarm if a heavy seizure occurs and when care is needed afterwards. The current detection system that are used in a home situation are most of the time not accurate enough, such as the audio triggered devices. [1]

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II. DATA ACQUISITION

The datasets are collected in collaboration with Pulderbos Rehabilitation Center in Zandhoven (Belgium) and contain apart from the video also other signals such as EEG, ECG and EOG. The patients are monitored during the night, and the epileptic events are labeled by a neurologist. This labeling is used as the golden standard.

III. METHOD

To extract the specific movement from the video we make use of the Horn-Schunck optical flow method [2]. This method calculates the motion vector field in each pixel of every video frame by stating that a change in pixel intensities occurs only because of motion and not by a change in brightness. In a first step we extracted the movement epochs from the video by calculating a one dimensional motion signal R(t) that is obtained by taking the mean of the amplitude of the largest motion vectors. A variable threshold (a multiple of the standard deviation of a reference epoch without movement added by the mean of this epoch) is than taken to distinguish movement from noise. The optimal values for the number of vectors and the threshold are determined and validated in a three-fold crossvalidation.

IV. FUTURE WORK

In a next step we want to distinguish epileptic movements from normal nocturnal movement by analyzing the specific pattern of the extracted motion signal for example by extracting features in the time and frequency domain and by combining it with other features from the motion vector field, for example by making use of 3D spatiotemporal template volumes, or by extracting features from clustered motion vector patches.

First step are already taken in the detection of myoclonic shocks. In a first approach features are extracted from the motion signal such as the amplitude and the direction of the motion. In a second approach the locations where movement occur are clustered, and the amplitude and direction of the

motion in each cluster are derived from the optical flow vectors. This gives a more accurate representation of complex motions.

In the end we want to discriminate between three types of epileptic seizure with a motor component namely the hypermotor seizures (frontal lobe) marked by heavy uncontrolled movement of the arms and legs, myoclonic shocks which are short contractions of muscles (e.g. arms or shoulders) and tonic(-clonic) seizures which are defined by stiffening of the muscles (e.g. the arms) sometimes followed by short shocks (the clonic phase).

V. CONCLUSION

A detection algorithm for nocturnal movement in epileptic children is developed and validated, resulting in a sensitivity of 1 and a positive predictive value of more than 0.85.

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