انجمن ماشین بینایی و پردازش تصویر ایران

شاخه دانشجویی مهندسی پزشکی

برگزار می کنند:

Problems of Automated Neonatal Seizure Detection: From Theory to Practice

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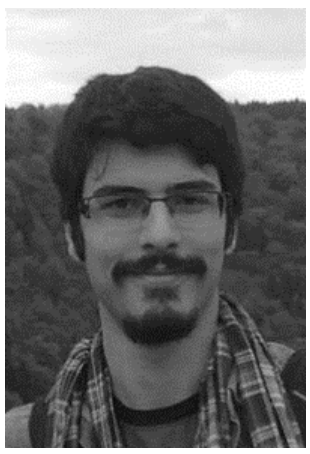
Abstract:

In neonatal intensive care units (NICUs), there is a need for around the clock interpretation of EEG, especially for recognizing seizures because of high susceptibility of neonates to seizure expression. Unlike epileptic seizures in adults, most neonatal seizures are subclinical and are not recognizable by clinical observation only. An automated seizure detector with an appropriate performance can partly fill this need. For this automatization, an extensive database including hours of the EEG-polygraphic recordings, EEG with ECG, EMG, EOG, etc., is needed and should be scored by at least one neurologist or an expert clinical neurophysiologist. However, accurately defining neonatal seizures is a great challenge, especially when the seizure discharges do not meet exacting definitions of repetitiveness or evolution in amplitude and frequency. This deniable ambiguity results in neither having high inter-rater agreement, nor high intra-rater consistency and should be taken into account not only in developing and training the algorithms, but also in measuring the performance. In order to measure the raters' agreement, 1919 clinically relevant events in 280h EEG from 71 neonates with seizures caused by different etiologies were reviewed by 4 secondary expert EEG raters and labeled as 'definite seizure', 'dubious seizure', and 'definite artifact'. Then, consensus decision was defined based on 'majority voting' for each event and inter-rater agreement was estimated using Fleiss' Kappa (=0.4). In order to use the feedback of the secondary raters, a new stage was added to a previously developed multi-stage neonatal seizure detector to retune the sensitivity using adaptive learning. This stage successfully decreased the false alarm rate by 35% and increased the positive predictive value by 5% while the good detection rate had no reduction. Furthermore, because of the low agreement of the raters, new performance metrics were needed to measure the performance of the neonatal seizure detectors in the presence of the raters' disagreement. To this end, the classical metrics, like sensitivity, specificity, and good detection rate, were fuzzily extended to take all raters' scores into account. The proposed metrics were compared with the classical metrics, which used majority voting technique, and showed higher accuracy and robustness for the proposed metrics. Results were confirmed using a bootstrapping test.



Biography: Amir H. Ansari received the B.E. degree in electrical (control) engineering from University of Shahed, Iran in 2009, and M.Sc. in bio-electrical engineering from University of Tehran, Iran in 2012. Currently, he is a Ph.D. student in the Katholieke Universiteit Leuven (KU Leuven), Belgium at the neonatal monitoring research group (NeoGuard) of the electrical engineering department (ESAT). He is also a researcher of iMinds Medical IT Department, Leuven, Belgium. His current research interests are machine learning techniques including neuro-fuzzy networks, convolutional neural networks, deep learning, and support vector machines, focusing on biomedical applications particularly on neonatal seizure detection problems.

زمان: سه شنبه ۷ دی ۱۳۹۵، ساعت ۱۲:۳۰ الی ۱۴

مکان: اتاق ۸۰۳ ، ساختمان شماره ۲ دانشکده مهندسی برق و کامپیوتر،

دانشکده های فنی دانشگاه تهران