# A Two Stage Method for Multi-Level Signal Quality Assessment of Magnetocardiography Signals

Dong Xu*, Ze Zhu, Min Xiang

National Institute of Extremely-Weak Magnetic Field Infrastructure
Hangzhou, Zhejiang, China

**Aims:** This study aimed to categorize the period-averaged multi-channel magnetocardiography (MCG) signals into low, medium and high quality signals, so as to avoid the possible misjudgments resulted by the complex and variable noise environment in and around the hospitals.

**Methods:** The 12-lead ECG was used to assist in the establishment of the data set for the quality assessment of MCG signals, containing healthy volunteers and patients with myocardial ischemia. A two-stage method for MCG signal quality assessment is proposed by combining the YOLO v5 algorithm and the ensemble machine learning model. The former is to detect the presence of the QRS complex, i.e., the most basic and prominent morphological wave in MCG signals, consequently categorizing signals into low quality and medium-to-high quality signals. The latter is utilized to construct a classification model based on multiple signal quality indices to further classify signals into high quality and medium quality signals. Evaluation metrics were accuracy, recall and specificity.

**Results:** The first stage method was established based on 1000 single-channel MCG signals, achieving 100% accuracy on the test data. The second stage method was established based on 2821 high-quality signals and 2219 medium-quality signals, reaching an accuracy rate of 96.2%, recall of 95.7% and specificity of 96.7% on the test data. In external tests performed on 284 cases of clinically-collected MCG signals, the accuracy rate reached 94.7%.

**Conclusions:** The present method seems to be reliable and feasible for clinical signal quality assessment before the MCG data interpretation.