

A Suitability Recognition Method for Multi-parameter Synchronous Analysis

Xianliang He, Sanchao Liu, Zehui Sun, Wenyu Ye, Jianwei Su, Haoyu Jiang, Cadathur Rajagopalan

Aims: Alarm fatigue has always been a clinical problem. Multi-parameter synchronous analysis (MPA) is a popular technology to solve this. However, there are some inapplicable cases practically, such as different signals are out-sync (severe peripheral circulation disorder, CPR etc) or even come from different patients. In these cases, important alarms may be omitted and patients are put at highly risk. This study focuses on recognizing scenarios that not suitable for MPA with single multi-parameter monitor.

Methods: Electrocardiograph (ECG) and pulse wave should be synchronous as they are of the same source. This proposed method includes following steps: firstly select signals sequence of good quality and sinus rhythm and analyze the dynamic change characteristics of ECG and pulse wave. Then extract the joint characteristics of multi-parameters, such as when heart rate changes, ECG and pulse wave will both change and match the time series characteristics, such as wave peak valley matching between ECG and pulse wave. Eventually, determine whether the multi-parameter signals are synchronized according to sequence lengths, and above characteristics.

Results: This study involves 400 clinical records, including 9 severe peripheral circulation disorder, 6 cardiopulmonary resuscitation (CPR), and 385 normal records. ECG and pulse waves of 185 different records were combined, and 15 special data were added to obtain 200 pieces of out-sync data. The recognition rate (RR) of out-sync cases was 91.5% when setting the sequence length to 30 seconds, and this RR was 95.5% when setting length to 300 seconds. Another 200 pieces of synchronous data were obtained from the same source. The RR of synchronism was 92% with 30 seconds sequence length, and 97% for 300 seconds.

Conclusion: The synchronic recognition method proposed in this study can effectively distinguish whether MPA is suitable for current situation.