A Novel Technique for Identifying Patients With ICU Needs using Hemodynamic Features

Ali Jalali*, Parham Ghorbanian, Ali Ghaffari and C Nataraj

Villanova, PA, United States

Identification of patients requiring intensive care is a critical issue in clinical treatment. Special care is usually only offered to those whose condition is potentially reversible and who have a good chance of surviving with extra care support. The objective of this study is to develop a novel methodology using hemodynamic features for distinguishing patients requiring intensive care from a group of healthy subjects. In this study, based on the hemodynamic features, subjects are divided into three groups: healthy, risky and patient. For each of the healthy and patient subjects, the evaluated features are based on the analysis of existing differences between hemodynamic variables: Blood Pressure and Heart Rate. Further, four criteria from the hemodynamic variables are introduced: circle criterion, estimation error criterion, Poincare plot deviation, and autonomic response delay criterion. For each of these criteria, three fuzzy membership functions are defined to distinguish patients from healthy subjects. Furthermore, based on the evaluated criteria, a scoring method is developed. In this scoring method membership degree of each subject is evaluated for the three classifying groups. Then, for each subject, the cumulative sum of membership degree of all four criteria is calculated. Finally, a given subject is classified with the group which has the largest cumulative sum. The proposed method was applied to 45 cases from Physionet database, containing 12 healthy subjects and 33 patients. From all cases, 37 cases were accurately detected, while there was one false detection. Furthermore, in five cases, one patient subject was classified as risky and in two cases, a healthy subject was classified as risky. From a clinical point of view, and in order to be conservative about patient cases, those five cases of risky detection would be considered as patient cases. In summary, the scoring method resulted in 97.6% sensitivity, 95.5% positive predictive accuracy, and 93.3% total accuracy.