DESIGN OF A CLINICAL DECISION SUPPORT FOR DETERMINING VENTILATOR WEANING USING SUPPORT VECTOR MACHINE

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ABSTRACT. Ventilator weaning is the process of discontinuing mechanical ventilators from patients with respiratory failure. This study designed a clinical decision support system (CDSS) using support vector machine (SVM) to predict if a patient can be weaned from mechanical ventilator successfully. A filter method based on logistic regression analysis (LRA) and a wrapper method based on recursive feature elimination (RFE) were adopted to select salient features in 27 variables, including demographic information, physiology and disease factors, and care and treatment factors for CDSS. Data of 348 patients were collected at four different periods from all-purpose respiratory care center. Seven significant variables ($p < 0.05$) using LRA contrasted to eleven variables using RFE algorithm were selected. The predictive accuracy under cross-validation is 88.33% (LRA) and 92.73% (RFE), respectively. The systems outperform predictors (75-78%) built using frequency-to-tidal volume ratio ($f/V_T$) and a model (78.6%) constructed recently using a combination of sample entropy of inspiratory tidal volume ($V_T$), expiratory tidal volume ($V_{TE}$), and respiration rate (RR). The CDSS constructed using SVM was shown to have better accuracy (91.25%) than using neural network (88.69%). Additionally, the designed CDSS with a graphic user interface (GUI) provides a valuable tool to assist physicians to determine if a patient is ready to wean from the ventilator.

Keywords: Ventilation weaning, Clinical decision support system, Neural network, Support vector machine, Recursive feature elimination, Logistic regression analysis