ABSTRACT

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When the cystic fibrosis studies began, it used to lead newborns to death after their first year of life. However, due to advances in treatment of cystic fibrosis, these patients have reached adulthood. Medical exams such as sweat test and spirometry, have been used as an attempt to diagnose the disease on its first stage, but these methods have not been efficient. Therefore, a new method is being studied to evaluate the mechanical properties of the respiratory system: the Forced Oscillation Technique (FOT). To prove the efficiency of this new technique, the present work proposes the use of machine learning algorithms to help the investigation and diagnosis of respiratory changes in cystic fibrosis. The data provided by FOT were used on the following algorithms: K Nearest Neighbor (K-NN), Radial Support Vector Machine (RSVM), Adaboost (ADAB) and Random Forest (RF). With the purpose of keeping a good accuracy and increase the interpretability of the results, this data was submitted to Bayesian Network synthesized by genetic algorithm (RBGAOT). From the experiments performed, the respiratory reactance provided by the FOT was the feature selection that presented the best individual performance (AUC=0.85). On the experiment with eight features, the RBGAOT had the best performance (AUC=0.88). When the methods of cross product and feature selection were applied, the K-NN and ADAB were the algorithms with the best results (AUC=0.89). The experiments realized showed that the use of machine learning algorithms increased the accuracy on the diagnosis of respiratory changes in cystic fibrosis. The inference about the networks constructed by RBGAOT generated an increase in the interpretability of the existing relation between the variables provided by the FOT.

Keywords: Cystic fibrosis; Forced oscillation technique; FOT; Machine learning; Bayesian Networks; Genetic algorithm; AUC.