Ensemble-based machine learning algorithms for classifying breast tissue based on electrical impedance spectroscopy

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ABSTRACT

The initial identification of breast cancer and the prediction of its category have become a requirement in cancer research because they can simplify the subsequent clinical management of patients. The application of artificial intelligence techniques (e.g., machine learning and deep learning) in medical science is becoming increasingly important for intelligently transforming all available information into valuable knowledge. Therefore, we aimed to classify six classes of freshly excised tissues from a set of electrical impedance measurement variables using five ensemble-based machine learning (ML) algorithms, namely, the random forest (RF), extremely randomized trees (ERT), decision tree (DT), gradient boosting tree (GBT) and AdaBoost (Adaptive Boosting) (ADB) algorithms, which can be subcategorized as bagging and boosting methods. In addition, the ranked order of the variables based on their importance differed across the ML algorithms. The results demonstrated that the three bagging ensemble ML algorithms, namely, RF ERT and DT, yielded better classification accuracies (78–86%) compared with the two boosting algorithms, GBT and ADB (60–75%). We hope that these our results would help improve the classification of breast tissue to allow the early prediction of cancer susceptibility.

KEYWORDS

Breast tissues; Machine learning; Ensemble learning; Classification; electrical impedence

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