MAIN AUDITORIUM

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Machine learning can reliably predict malignancy of BI-RADS 4a and 4b breast lesions based on clinical and ultrasonographic features

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Objective: The objectives of this study were to establish the most reliable machine learning model to predict malignancy in BI-RADS 4a and 4b breast lesions and optimize the negative predictive value to minimize unnecessary biopsies. **Methodology:** We included clinical and ultrasonographic attributes from 1,250 breast lesions from four institutions classified as BI-RADS 3, 4a, 4b, 4c, 5, and 6. We selected the most informative attributes to train the models in order to make inferences about the diagnosis of BI-RADS 4a and 4b lesions (validation dataset). Using the best parameters and hyperparameters selected, we tested the performance of nine models and 1,530 ensemble models. **Results:** The most informative attributes were shape, margin, orientation, and size of the lesions, the resistance index of the internal vessel, the age of the patient, and the presence of a palpable lump. The highest mean NPV was achieved with XGBoost (93.6%). The final performance of the best ensemble model was NPV=96.4%, sensitivity=81.5%, specificity=84.1%, PPV=46.8%, f1-score=59.5%, and the final accuracy=83.7%. Age was the most important attribute to predict malignancy. The use of the final model associated with the patient's age would reduce by 51% the number of biopsies in women with BI-RADS 4a or 4b lesions. **Conclusion:** Machine learning can predict malignancy in BI-RADS 4a and 4b breast lesions identified by ultrasonography, based on clinical and ultrasonographic features. Our final prediction model would be able to avoid 51% of the 4a and 4b breast biopsies, without missing any cancers.

Keywords: ultrasonography; machine learning; artificial intelligence; image-guided biopsy.