Improved artificial neural networks in prediction of malignancy of lesions in contrast-enhanced MR-mammography

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The aim of this study was to evaluate the capability of improved artificial neural networks (ANN) and additional novel training methods in distinguishing between benign and malignant breast lesions in contrast-enhanced magnetic resonance-mammography (MRM). A total of 604 histologically proven cases of contrast-enhanced lesions of the female breast at MRI were analyzed. Morphological, dynamic and clinical parameters were collected and stored in a database. The data set was divided into several groups using random or experimental methods [Training & Testing (T&T) algorithm] to train and test different ANNs. An additional novel computer program for input variable selection was applied. Sensitivity and specificity were calculated and compared with a statistical method and an expert radiologist. After optimization of the distribution of cases among the training and testing sets by the T & T algorithm and the reduction of input variables by the Input Selection procedure a highly sophisticated ANN achieved a sensitivity of 93.6% and a specificity of 91.9% in predicting malignancy of lesions within an independent prediction sample set. The best statistical method reached a sensitivity of 90.5% and a specificity of 68.9%. An expert radiologist performed better than the statistical method but worse than the ANN (sensitivity 92.1%, specificity 85.6%). Features extracted out of dynamic contrast-enhanced MRM and additional clinical data can be successfully analyzed by advanced ANNs. The quality of the resulting network strongly depends on the training methods, which are improved by the use of novel training tools. The best results of an improved ANN outperform expert radiologists. © 2003 American Association of Physicists in Medicine. [DOI: 10.1118/1.1600871]

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