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Breast Cancer Staging by Using TNM System and Ant Colony Algorithm

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Abstract

Introduction: Staging is one of the most important factors determining the survival of a patient suffering from breast cancer and plays a key role in choosing treatment modalities. The method of choice for cancer staging is surgery followed by histological evaluation. However, finding a predictive algorithm to replace surgery in the staging of breast cancer is both cost- and time-saving and helps physicians to provide appropriate therapeutic techniques. The present paper introduces a strong predictive model for breast cancer staging using data mining techniques.

Methods: We suggested a mechanized model based on the TNM staging system and the ant colony algorithm. This method would reduce the patient's mental stress and financial costs because it does not need a surgical operation. The SEER international dataset and a local data set of 1148 women with breast cancer were used to evaluate the system performance, and model accuracy and the area under the ROC curve were calculated for different classifications.

Results: Using the TNM system, the accuracy rates were 99.93% and 99.91% for the SEER international dataset and the local dataset, respectively. The accuracy rates were 99.43% and 98.95% for the SEER international dataset and local dataset, respectively, when the ant colony algorithm was applied. Our results indicated that in addition to commonly used features in the TNM system, other features such as vascular invasion, age, blood group, number of children, birthplace, histology, CS Extension, positive regional node, morphology, and Site-Specific Factors 2, 3, and 6 can be used as important factors for breast cancer staging.

Conclusion: Based on the results obtained, the two Logistic and Multi-Class Classifiers have the best accuracies for the SEER and local datasets in this study.

Keywords: Breast Cancer, Stage detection, Data mining, TNM system, Ant Colony Algorith