Abstract

For accurate cancer staging it is crucial to detect malignancies in lymph nodes. Current methods rely on surgical exploration and pathological examination. In this thesis methods are proposed for classifying metastases in lymph nodes with a Bayesian network model based on noninvasive lymph node detection with lymphotropic magnetic resonance imaging (LN-MRI). Linear methods of finding cut-off values for the clinical parameters were analyzed and compared with already published models. A Bayesian network model, which is able to enhance the classification by combining the parameters, has been developed. Entropy based preprocessing methods were used for discretization and feature selection. An algorithm to construct a Bayesian network, which is based on Information Theory, is described, and furthermore the model is validated with various cross-validation methods and compared with the results of other classification methods. The method proposed is accurate in classification and at the same time supportive for the clinician by providing a graphical model, which describes the relationships between the parameters and the state of malignancy of the lymph nodes. On a dataset of 216 histologically validated lymph nodes this approach achieves an overall classification accuracy of 98.6%.

Keywords: Non-invasive cancer detection, Classifier, Bayesian network, Lymph node, Nanoparticle-enhanced lymphotropic magnetic resonance imaging (LN-MRI)