

The confident detection and monitoring of metastatic bone disease remains one of the major unfulfilled needs in oncology. Whole-body MRI offers excellent resolution and sensitivity for the detection of neoplastic cells within the bone marrow using so-called anatomical sequences. In combination with whole-body diffusion-weighted functional sequences, it has shown a great potential in the assessment of patient tumor involvement. However, metastatic bone disease can lead to a large amount of bone lesions spread across the skeleton, making it impractical and labor demanding to manually delineate by a radiologist. Computer-aided detection could alleviate the workflow, enabling automatic, accurate and reproducible study of the patient tumor load. In this paper, we propose a fully automated computer-aided detection system for bone metastases composed of two steps. First, whole-body multi-modal MR image preprocessing is performed consisting of intra- and inter-modality image spatial registration, intensity standardization and atlas-based segmentation of the skeleton. The second stage detects the metastases candidates using random forest voxel classification algorithm. The system is evaluated on the dataset of 6 male advanced prostate cancer patients with metastases to the bone using a leave-one-patient-out cross-validation with manual segmentation of the metastases as the reference standard. The proposed system showed metastases detection sensitivity of 0.74 with a median false positive rate of 9.67. In clinical workflow the system could potentially be used as the initial screening and treatment response assessment tool for whole-body multi-modal MRI of any advanced cancer with metastases to the bone