High Time-Resolved Cardiac Functional Imaging Using Temporal Regularization for Small Animal on a Clinical 3T Scanner

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Precise assessment of mice cardiac function with MRI constitutes an essential tool for longitudinal studies and/or for drug development concerning cardiovascular diseases. Whereas dedicated small animal MR scanners are not readily available, it would be a great advantage to be able to perform cardiac assessment on clinical systems, in particular, in the context of translational research. However, mouse imaging remains challenging since it requires high spatial and temporal resolution, while gradient performances of clinical scanners often limit the reachable parameters. In this study we propose a new cine sequence, named "interleaved cine", which combines two repetitions of a standard cine sequence shifted in time in order to reach resolution parameters compatible with mice imaging. More precisely this sequence allows temporal resolution to be reduced to 6.8 ms instead of 13.5 ms initially limited by the system hardware. We propose a two-step denoising algorithm to suppress some artifacts inherent to the new interleaved cine thus allowing an efficient enhancement of the image quality. In particular, we model and suppress the periodic intensity pattern and further denoise the sequence by soft-thresholding of the temporal Fourier coefficients. This sequence was successfully validated with mass and function measurements on relevant mice models of cardiovascular diseases.