A New Approach for Motion Correction in SPECT Imaging

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Abstract. Due to the long imaging times in SPECT, patient motion is inevitable and constitutes a serious problem for any reconstruction algorithm. The measured inconsistent projection data lead to reconstruction artifacts which can significantly affect the diagnostic accuracy of SPECT if not corrected. Among the most promising attempts for addressing this cause of artifacts is the so-called data-driven motion correction methodology. But even this algorithm is restricted to the correction of abrupt rigid patient motion and exclusive correction of gradual motion, which may lead to unsatisfactory results. In this note we present for the first time a motion correction approach which overcomes the mentioned restrictions. The new approach is based on the super-resolution methodology. To demonstrate the performance of the proposed scheme, corrections of abrupt and gradual motion are presented.

1 Introduction

In Single Photon Emission Computed Tomography (SPECT), the imaging time is typically in the range of 5-30 minutes. Here, patient movement, which has frequently been reported in clinical applications [1], constitutes a serious problem for any reconstruction scheme. The movements cause misalignment of the projection frames, which degrades the reconstructed image and may introduce artefacts. These motion artefacts may significantly affect the diagnostic accuracy [2, 3, 4]. Different methods have been proposed for the correction of motion in SPECT studies. These methods may be divided into three categories. The first two approaches do produce motion corrected projections and thus may be used in conjunction with any reconstruction method. The first approach is purely hardware based, like, for example the triple scan [5] or dual scan [6] protocol. The second approach corrects for the patient motion by using a computational method applied within the projection-space [7, 8]. It should be noted, that due to the projection geometry the latter method is not able to compensate for rotational movement. In this paper, we are concerned with the third methodology. Here the correction is performed in the image space. A widely used member out of this class is the so-called data driven motion correction (DDMC) approach [9, 10]. It can handle full rigid-body motion. To start the scheme, it is assumed that the point in time of the rigid-body motion of the patient during the SPECT